



Training and Support



2017-2018 *FIRST*[®] Tech Challenge Game Manual Part 2



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Thank you for taking the time to volunteer for a *FIRST*® Tech Challenge event. *FIRST*® and *FIRST*® Tech Challenge rely heavily on volunteers to ensure events run smoothly and are a fun experience for teams and their families, which could not happen without people like you. With over 4,600 teams competing yearly, your dedication and commitment are essential to the success of each event and the *FIRST* Tech Challenge program. Thank you for your time and effort in supporting the mission of *FIRST*!



Revision History		
Revision	Date	Description
1	8/22/2017	Limited Affiliate Partner Release
1.1	9/9/2017	<ul style="list-style-type: none"> Kickoff Release Updated cover page Update to Sponsor and Volunteer Thank You Section 1.3 – Updated link to official field measurements
1.2	10/3/2017	<ul style="list-style-type: none"> Section 1.4 – Corrected measurements to <i>Safe Zone</i> Section 1.5.1 – Further clarification to orientation of <i>Balancing Stones</i> Section 1.5.3 – Clarification to the transition from <i>Autonomous</i> to <i>Driver Controlled Periods of the Match</i> Appendix A – Removed volunteer on call support info Appendix E – Changed 2 to 12 in paragraph.
1.3	10/25/2017	<ul style="list-style-type: none"> Section 1.5.4 – End Game Relic – Score clarification Section 1.5.5 – Post Match – Score Tracker will record the status of the field, not the referee. Section 1.6.2 – Rule <G13> - Score Trackers track the status of the field throughout the Match.
1.4	11/21/2017	<ul style="list-style-type: none"> Section 1.4 and Appendix F – Changed Glyph tolerances from 0.0125 inches to 0.25 inches Section 1.6.2 – Rule <G27> - Updated Egregious Behavior rule

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Introduction

What is FIRST® Tech Challenge?

FIRST Tech Challenge is a student-centered program that focuses on giving students a unique and stimulating experience. Each year, teams engage in a new Game where they design, build, test, and program autonomous and driver operated robots that must perform a series of tasks.

They also cultivate life skills such as:

- Planning, brainstorming, and creative problem-solving.
- Research and technical skills.
- Collaboration and teamwork.
- Appreciating differences and respecting the ideas and contributions of others.

To learn more about FIRST Tech Challenge and other FIRST® Programs, visit www.firstinspires.org.

FIRST Tech Challenge Core Values

FIRST asks everyone who takes part in FIRST Tech Challenge to uphold the following values:

- We display *Gracious Professionalism*® with everyone we engage with and in everything we do.
- We act with integrity.
- We have fun.
- We are a welcoming community of students, Mentors, and Volunteers.
- What we learn is more important than what we win.
- We respect each other and celebrate our diversity.
- Students and adults work together to find solutions to challenges.
- We honor the spirit of friendly competition.
- We behave with courtesy and compassion for others always.
- We act as ambassadors for FIRST and FIRST Tech Challenge.
- We inspire others to adopt these values.

**FIRST Tech Challenge is
MORE THAN ROBOTSSM!
While competing, students
develop personal and
professional skills they will
be able to rely on
throughout their life.**

Gracious Professionalism®

FIRST uses this term to describe our programs' intent and is shared with all young people engaging in FIRST programs. At FIRST, team members help other team members, but they also help other teams.

Gracious Professionalism® is not clearly defined for a reason. It has different meanings to everyone.

Some possible meanings of *Gracious Professionalism* include:

- Gracious attitudes and behaviors are win-win.
- Gracious folks respect others and let that respect show in their actions.

An example of *Gracious Professionalism* is patiently listening to a team's question and providing support despite having several pressing things to do on the day of the event.

- Gracious Professionals make valued contributions in a way that is pleasing to others and to themselves.

In *FIRST*, *Gracious Professionalism* teaches teams and student participants:

- Learn to be strong competitors, but also treat one another with respect and kindness in the process.
- Avoid leaving anyone feeling as if they are excluded or unappreciated.
- Knowledge, pride and empathy should be comfortably and genuinely blended.

In the end, *Gracious Professionalism*® is part of everyday life. When professionals use their knowledge in a graciously and individuals act with integrity and sensitivity, everyone wins, and society benefits.

Watch Dr. Woodie Flowers explain *Gracious Professionalism* in this [short video](#).

Gracious Professionalism for Volunteers

It is a good idea to spend time going over this concept with Volunteers. Provide Volunteers with real-life examples of *Gracious Professionalism* in practice before, during, and after the event and recognize great *Gracious Professionalism* when you see it in action!

Youth Protection Program

The *FIRST* YPP sets minimum standards recommended for all *FIRST* activities. Adults working in *FIRST* programs must be knowledgeable of the standards set by the *FIRST* YPP, as well as those set by the school or organization hosting their team.

Youth Protection Expectations and Guidelines

Coaches and Mentors should read and follow the [FIRST Youth Protection Program guide](#). Anything labeled as required is mandatory in the United States and Canada, and cannot be waived without approval from the *FIRST* Youth Protection Department. *FIRST* recommends that the standards set forth in the *FIRST* Youth Protection Program guide be applied outside of the United States and Canada to the extent possible. At a minimum, local regulations regarding youth protection must be complied with.

Most up to date forms are available here: <http://firstinspires.org/resource-library/youth-protection-policy>

The US Screening process, the Canadian Screen process, Frequently Asked Questions (FAQ), and additional information are on the *FIRST* Youth Protection Program Website: <http://firstinspires.org/resource-library/youth-protection-policy>

NOTICE OF NON-DISCRIMINATION

For Inspiration and Recognition of Science and Technology (*FIRST*®) does not discriminate based on race, color, national origin, sex, disability, age, status as a veteran who served in the military, religion, gender, gender identity, or gender expression in its programs and activities.

Keep updated at: <http://www.firstinspires.org/about/legal-notices>

1.0 The Game

1.1 Introduction

This document describes *FIRST*® RELIC RECOVERYSM presented by Qualcomm® Incorporated, the *FIRST*® Tech Challenge game for the 2017-2018 season. *Teams* must comply with all rules and requirements stated in this document and in Part 1 of the Game Manual. Clarifications to the game rules are issued on the Question & Answer section of the game forum at FTCFORUM.USFIRST.ORG. Forum rulings take precedence over information in the game manuals.

1.2 Game Description

Matches are played on a *Playing Field* initially set up as illustrated in Figure 1.3-1 below. Two *Alliances* – one “Red” and one “Blue,” composed of two *Teams* each – compete in each *Match*. The object of the game is to attain a higher *Score* than the opposing *Alliance* by *Scoring Glyphs* into the *Cryptoboxes*, transferring *Relics* to the *Recovery Zone*, retrieving *Jewels*, balancing on the *Balancing Stones*, performing *Autonomous* tasks, and navigating to specific parts of the *Playing Field*. The *Scoring Elements* for the game are 48 *Alliance* neutral *Glyphs*, 8 *Alliance*-specific *Jewels* (4 per *Alliance*) and 4 *Alliance*-specific *Relics* (2 per *Alliance*). The game is played in two distinct periods: *Autonomous* and *Driver-Controlled*.

The *Match* starts with a 30-second *Autonomous Period* in which *Robots* operate using pre-programmed instructions only. *Alliances* earn points by: (1) Selecting and removing opponent colored *Jewels*, (2) *Scoring Glyphs* into the *Cryptoboxes*, and (3) *Parking* their *Robot* in a *Safe Zone*.

The two-minute *Driver-Controlled Period* follows the *Autonomous Period*. During this period, *Teams* earn points for their *Alliance* by: (1) *Scoring Glyphs* into their *Alliance*'s *Cryptoboxes* and (2) Creating *Cipher* patterns with their *Glyphs* in the *Cryptoboxes*.

The final 30 seconds of the *Driver-Controlled Period* is called the *End Game*. In addition to the previously listed *Driver-Controlled Period Scoring* activities, *Alliances* earn points by (1) moving their *Relics* to safety in the *Recovery Zone* and (2) balancing *Robots* on the *Balancing Stones*.

1.3 Playing Field Illustration

The following illustration identifies the *Game Elements* and give a general visual understanding of the game. *Teams* should refer to andymark.com/FTC for the exact *Game Element* dimensions. The official *Playing Field* documents including the official Field Setup Guide are available at <https://www.firstinspires.org/resource-library/ftc/game-and-season-info>. Please note: *Playing Field* wall heights may be different depending on the manufacturer. Measurements are located in the official Field Setup Guide. Please incorporate that into the design of your *Robot*.

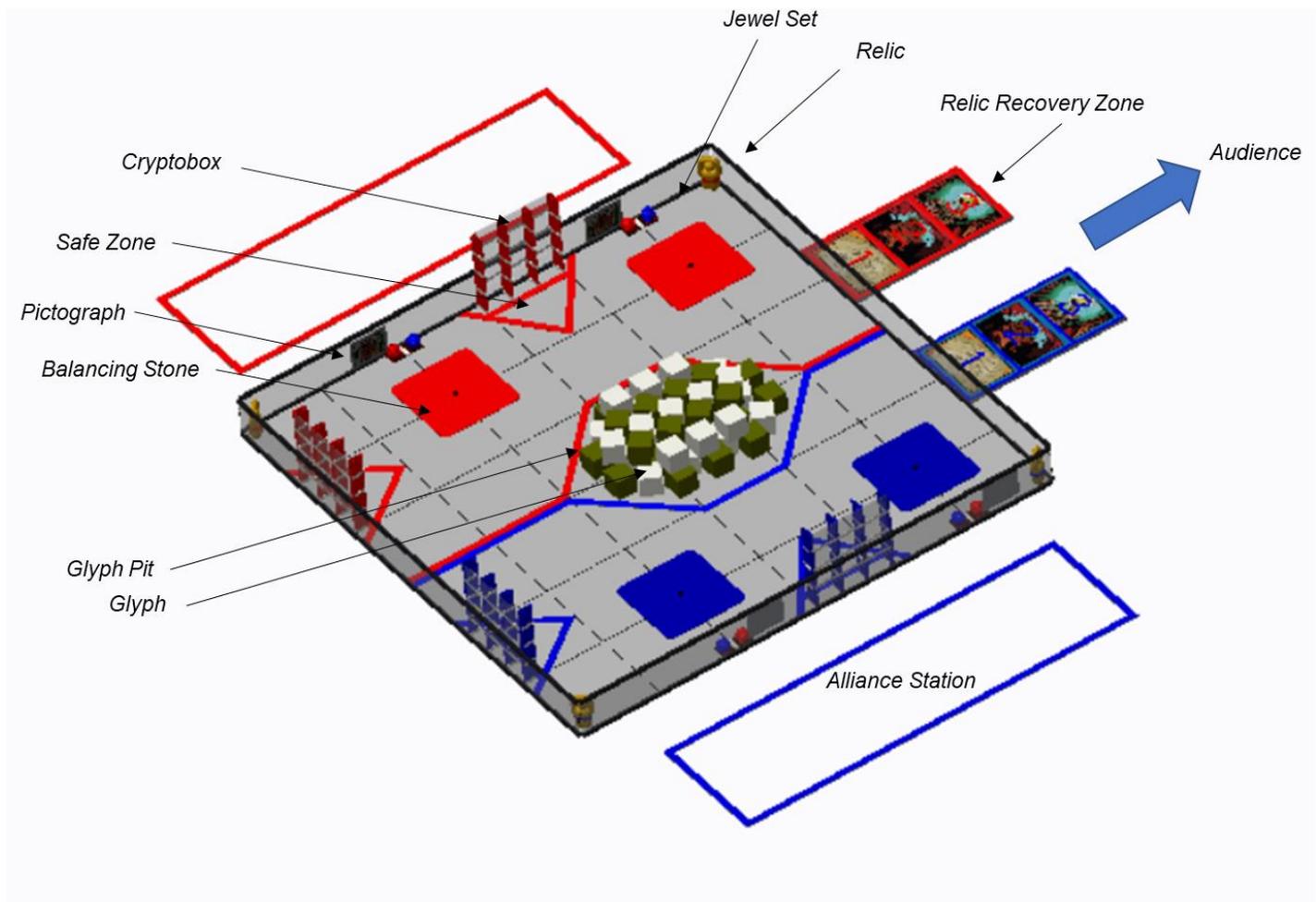


Figure 1.3-1 – Isometric view of the *Playing Field*

1.4 Game Definitions

The following definitions and terms are used in FIRST® RELIC RECOVERYSM presented by Qualcomm® Incorporated:

Alliance – A grouping of two *Teams* that work together for a given *Match*. *Alliances* are designated as either “Red” or “Blue.”

Alliance Station – The designated “Red” or “Blue” *Alliance Area* adjacent to the *Playing Field* where the *Drivers* and *Coach* stand or move within during a *Match*. *Station One* is the *Alliance Station* closest to the audience.

Area – The space defined by the vertical projection of the outside edge of a region’s boundary (for example, gaffers tape, goal, *Playing Field Wall*). The boundary element (tape, wall, markings, etc.) is considered to be part of the *Area* for the purposes of determining *Inside* and *Outside*.

Autonomous Period – A thirty-second period in which the *Robots* operate and react only to sensor inputs and to commands pre-programmed by the *Team* onto the onboard *Robot* control system. Human control of the *Robot* is not permitted during this time.

Balanced – The condition where a *Robot* is *Completely Supported* by a single *Balancing Stone* and no outer edge of the *Balancing Stone* is *Supported* by the *Playing Field Floor*, *Robot* parts, or *Game Elements*.

Balancing Stone – A 23 inches (58.4 cm) x 23 inches (58.4 cm) surface located approximately 2 inches (5.08 cm) above the *Playing Field Floor*. The *Balancing Stone* surface is *Supported* by a 5.75 inches (14.6 cm) x 5.75 inches (14.6 cm) x 1.375 inch (3.5 cm) tall pylon.

Block / Blocking – Preventing an opposing *Alliance Robot* from accessing an *Area* or *Alliance-specific Game Element* for an extended period by obstructing ALL paths of travel to the object or *Area*. Active defense played by a *Robot* shadowing an opposing *Alliance Robot* that effectively eliminates all paths of travel between the opposing *Alliance Robot* and an *Area* or *Alliance-specific Game Element* is considered *Blocking*, even though at any frozen point in time there is an open path. See also *Trap / Trapping* (which may be considered the same except it is FROM a *Game Element* or *Area* of the *Playing Field*).

Cipher – The *Cipher* is a pattern of twelve (12) brown and gray *Glyphs* Scored into a *Cryptobox*. There are six (6) *Ciphers* (see [Appendix E](#)) that if completed by an *Alliance* will earn that *Alliance* points and the ability to *Score* a *Relic* prior to the *End Game*.

Coach – A student *Team* member or adult mentor designated as the *Drive Team* advisor during the *Match* and identified by wearing a “Coach” badge or identifying marker.

Column – There are three (3) *Columns* per *Cryptobox*; *Left*, *Center*, and *Right*. A *Column* is *Scored* when there are four (4) *Scored Glyphs* in the *Column* and there is a *Scored Glyph* in each of the four (4) *Rows* that make up that *Column*.

Competition Area – The *Area* where all the *Playing Fields*, *Alliance Stations*, scoring tables, on-deck queuing tables, event officials, and other tournament items relating to *Match* play are located. The *Team Pit Area* and practice *Playing Fields* are not part of the *Competition Area*.

Control / Controlling – An object is considered to be *Controlled* by a *Robot* if the object is following the movement of the *Robot*. Objects that are *Controlled* by a *Robot* are considered to be part of the *Robot*. See *Possess / Possessing* to learn about a related term. Examples include, but are not limited to:

- Carrying – holding *Game Elements Inside* or *Outside* of a *Robot*.
- Herding – pushing or impelling *Game Elements* to a desired location or direction that gains a strategic advantage beyond moving the *Robot* around the field.
- Holding – *Trapping* one or more *Scoring Elements* against a *Game Element*, *Playing Field Wall*, or *Robot* in an attempt to shield or guard them.
- Launching – propelling *Game Elements* into the air or throwing in a forceful way.

Examples of interaction with *Game Elements* that are not *Controlled* include, but are not limited to:

- Plowing – *Inadvertent* contact with *Game Elements* while in the path of the *Robot* moving about the *Playing Field*.
- Deflecting – *Inadvertent* contact with a launched *Game Element* as it bounces off a *Robot*.

Cryptobox – An *Alliance*-specific *Scoring Area* where *Robots* place *Glyphs*. Each *Cryptobox* contains three (3) vertical *Columns* and four (4) horizontal *Rows*. There are four (4) *Alliance*-specific *Cryptoboxes* (2 red, 2 blue).

Cryptobox Key – A randomly selected *Cryptobox Column* used as a *Scoring* achievement during the *Autonomous Period*.

Disable / Disabled – A *Robot* that is no longer active for the remainder of the *Match* due to a *Robot* failure or by the request of a referee. *Teams* may not *Disable* a *Robot* without the permission of a Field Technical Advisor or referee. If a referee *Disables* a *Robot* during a *Match*, he/she will ask the *Team* to drive their *Robot* to a neutral position on the *Playing Field*, issue a stop command with the *Driver Station*, and place their *Driver Station* in a hands-off location on a tournament-provided structure or the *Alliance Station* floor.

Disqualified / Disqualification / Disqualify – A *Team* that is *Disqualified* from a *Match* has their *Robot Disabled* and will not receive credit for the *Match* (i.e., no Qualifying or Ranking points).

Drive Team – Up to three representatives (two *Drivers* and one *Coach*) from the same *Team*.

Driver – A pre-college student *Team* member responsible for operating and controlling the *Robot* and identified by wearing a tournament supplied “*Driver*” badge or identifying marker.

Driver-Controlled Period – The two-minute time period in which the *Drivers* operate the *Robots*.

Driver Station – Hardware and software used by a *Drive Team* to control their *Robot* during a *Match*. The *Driver Station* consists of an Android device, *FIRST* Tech Challenge supplied Android App, adapter cable(s), optional non-powered (i.e., does not draw power from a DC power input port) USB Hub, an optional commercial off the shelf USB external battery connected to the USB Hub to charge the Android device at any time, and up to two controllers to drive the *Robot*. The only allowed controller models are the Logitech F310 Gamepad and the Xbox 360 Controller for Windows (Part #: 52A-00004).

End Game – The last thirty seconds of the *Driver-Controlled Period*.

Game Element – Any item *Robots* interact with to play the game. *Game Elements* for this year’s game include: *Glyphs*, *Relics*, *Jewels*, *Balancing Stones*, *Relic Recovery Zones*, *Pictographs*, and the *Cryptoboxes*.

Glyph – An *Alliance* neutral *Scoring Element* for the game. The *Glyph* is a foam cube measuring approximately 6 inches ± 0.25 inches (15.2 cm ± 0.635 on a side. Brown *Glyphs* weigh approximately 4.18 ounces (118.39 gm) and gray *Glyphs* weigh approximately 3.83 ounces (108.64 gm). There are twenty-four (24) gray *Glyphs* and twenty-four (24) brown *Glyphs*.

Glyph Scoring – A *Glyph* is considered *Scored* when any part of the *Glyph* is between two *Cryptobox Rails* and is not in contact with a *Robot* of the corresponding *Alliance*. A 2 inch wide strip of tape is placed on the *Playing Field Floor* across the tips of the *Rails* to provide a visual aid to help determine if a *Glyph* is between the *Rails*. See Appendices C and D for further detail.

Glyph Pit – The location where forty-four (44) *Glyphs* reside at the start of a *Match* (there are an additional four (4) *Glyphs* Pre-loaded into the *Robots*). The *Glyphs* are randomly placed into the *Glyph Pit*.

In (Inside) / Completely In (Completely Inside) – An object that has crossed into the upwards vertical (i.e., at a right angle to the *Playing Field Floor*) extension of a defined *Area*'s boundary is *Inside* the *Area*. An object that is entirely within the upwards vertical extension of a defined *Area*'s boundary is *Completely Inside* the *Area*. The boundary element (tape, wall, markings, etc.) is part of the *Area* for the purposes of determining *Inside* and *Outside*.

Inadvertent – An outcome that is not a planned strategy and not the predictable result of persistent or repeated actions.

Inconsequential – An outcome that does not influence *Scoring* or gameplay.

Jewel – An object that *Robots* interact with during the *Autonomous Period* to earn points for their *Alliance*. FIRST® RELIC RECOVERYSM is played with four (4) *Jewel Sets* which are located as shown in Figure 1.3-1. There are four (4) *Jewels* per *Alliance*. The *Platform* is a 0.48 inches (1.2 cm) thick plate with two holes into which the *Jewels* are placed. The *Platforms* are not affixed to the *Playing Field* in any manner. The *Jewels* measure 3.75 inches (9.5 cm) in diameter and weigh approximately 1.98 ounces (56.13 gm).

Jewel Set – *Jewel Set* consists of a platform and two *Jewels*. Each *Jewel Set* starts the *Match* with two *Jewels*, one red, one blue.

Match – A head-to-head competition between two *Alliances*. A *Match* consists of a thirty-second *Autonomous Period* followed by a two-minute *Driver-Controlled Period* for a total time of two minutes and thirty seconds.

Off / Completely Off – Not physically in contact with or *Supported* by an object, surface, etc.

On / Completely On – An object that is physically in contact with and at least partially *Supported* by an object, surface, etc. is considered *On*. An object that is entirely *Supported* by another object, surface, etc. is *Completely On*.

Out / Outside – An object that has NOT crossed into any part of a defined *Area* is *Outside* the *Area*.

Park / Parked – The condition where a *Robot* is motionless.

Penalty – The consequence imposed for a rule or procedure violation that is identified by a referee. When a *Penalty* occurs, points will be awarded to the *Alliance* that did not incur the *Penalty*. *Penalties* are further defined into *Minor Penalties* (ten points) and *Major Penalties* (forty points). *Penalties* may also escalate to issuing of a *Yellow Card* or *Red Card* as a result of a continued occurrence of a rule violation and upon discretion of the Referee.

Yellow Cards and Red Cards – In addition to rule violations explicitly listed in section 1.6, *Yellow Cards* and *Red Cards* are used in the FIRST Tech Challenge to manage *Team* and *Robot* behavior that does not align with the mission of FIRST.

The Head Referee may assign a *Yellow Card* as a warning, or a *Red Card* for *Disqualification* in a *Match*, as a result of egregious *Robot* or *Team* member behavior, or repeated (3 or more) violations of a rule at the event. A *Yellow Card* or *Red Card* is indicated at the end of a *Match* by the Head Referee standing in front of the *Team's Alliance Station* and holding a *Yellow Card* and/or *Red Card* in the air.

Yellow Cards are additive, meaning that a second *Yellow Card* is automatically converted to a *Red Card*. A *Team* is issued a *Red Card* for any subsequent incident in which they receive an additional *Yellow Card*, including earning a second *Yellow Card* during a single match. To issue the second *yellow card*, the Head Referee will stand in front of the *Team's Alliance Station* and hold a *Yellow Card* and *Red Card*. The Head Referee will signal the second *Yellow Card* after the match has ended.

A *Team* that has received either a *Yellow Card* or a *Red Card* carries a *Yellow Card* into following matches, except as noted below. A *Red Card* results in match *Disqualification*. Multiple *Red Cards* may lead to *Tournament Disqualification*. Once a *Team* receives a *Yellow Card* or *Red Card*, the *Team* number is presented with a yellow background on the audience screen at the beginning of all following matches. This is a reminder to the *Team*, referees, and audience the *Team* carries a *Yellow Card*.

Yellow Cards do not carry over from the qualification *Matches* to the elimination *Matches*. During the elimination *Matches*, *Yellow* and *Red Cards* count against the entire *Alliance*, not to a specific *Team*. If a *Team* receives a *Yellow Card* or *Red Card*, it results in the entire *Alliance* receiving the *Yellow Card* or *Red Card* for that *Match*. If two different *Teams* on the same *Alliance* are issued *Yellow Cards*, the entire *Alliance* is issued a *Red Card*. A *Red Card* results in zero (0) points for that *Match*, and the *Alliance* loses the *Match*. If both *Alliances* receive *Red Cards*, the *Alliance* which committed the action earning the *Red Card* first chronologically loses the *Match*.

Pictograph – An image containing an encoded message that reveals the location of the *Cryptobox Key*. The *Pictograph* is attached to the *Playing Field Wall* adjacent to each *Jewel* platform. There are three different *Pictographs*, each representing a different *Column* in the *Cryptobox*. The *Pictograph* is randomly chosen prior to the start of each *Match* as described in [Appendix G](#). *Pictographs* are difficult for humans to decode; however, a *Robot* can easily decrypt the *Pictograph* using its onboard Android phone camera and the *Vuforia* software built into the *FIRST* Tech Challenge software development kit.

Pin / Pinning – Preventing the movement in ALL directions of an opposing *Alliance Robot* while it is in contact with the *Playing Field Wall*, one or more *Game Elements*, or another *Robot*.

Playing Field – The part of the *Competition Area* that includes the 12 ft. x 12 ft. (3.66 m x 3.66 m) field, the *Recovery Zone*, and all the *Game Elements* described in the official field documents. From the audience viewpoint, the *Red Alliance Area* is on the right side of the *Playing Field*.

Playing Field Damage – A physical change to a *Game Element* or *Playing Field* that affects game play or an action that causes harm to the playability of a *Game Element* or *Playing Field*.

For example: Black tire marks on a *Game Element* is not considered *Playing Field Damage*. However, digging a hole larger than 1 inch (2.54 cm) diameter (approximately the size of a US quarter) into the *Playing Field* tiles or *Glyphs* is considered *Damage*.

Playing Field Floor – The surface of the tiles that make up the base of the *Playing Field*.

Playing Field Perimeter – The outside face of the *Playing Field Wall*.

Playing Field Wall – An approximate 12 inches (0.3m) tall, 12 ft. (3.66 m) long by 12 ft. (3.66 m) wide wall surrounding the *Playing Field Floor*. The height of the *Wall* will vary depending on which *Playing Field Wall* is being used at the event. *Robots* should be built to interact with all legal perimeters.

Possess / Possessing – An object is in *Possession* by a *Robot* if, as the *Robot* moves or changes orientation (for example, moves forward, turns, backs up, spins in place), the object remains in approximately the same position relative to the *Robot*. Objects in *Possession* of a *Robot* are considered to be *Controlled*, and they are part of the *Robot*. See also *Control/Controlling*.

Rail – The portion of the *Cryptobox* that extends from the back panel of the *Cryptobox* onto the field where *Glyphs* can be *Scored*. The color of the *Rails* indicate which *Alliance* owns the *Cryptobox*.

Recovery Zone – There are two (2) *Alliance-specific Recovery Zone* mats that are located outside the *Playing Field Perimeter*, adjacent to the wall facing the audience. Each *Recovery Zone* contains three (3) distinct *Scoring Areas* at different distances from the *Playing Field Wall* where a *Robot* may place a *Relic*. The *Scoring Areas* are designated as 1, 2, and 3. *Recovery Zone 1* is closest to the *Playing Field Wall*.

Relic – An *Alliance-specific Scoring Element*. The *Relics* measure 6.0 inches (15.2 cm) side to side, 3.25 inches (8.25 cm) front to back, and 10 inches (25.4 cm) tall and weigh approximately 4.72 ounces (214 gm) each. There are four (4) *Relics*, two (2) per *Alliance*. At the start of a *Match*, one *Relic* is placed in each corner of the *Playing Field Wall*, the *Relic* will be in a standing orientation and must touch both adjacent walls. The two (2) *Blue Relics* are adjacent to the wall in front of the *Blue Alliance Station* and the two (2) *Red Relics* are adjacent to the wall in front of the *Red Alliance Station*.

Robot – Any mechanism that has passed inspection and a *Drive Team* places on the *Playing Field* prior to the start of a *Match*. A detailed definition of *Robot* is in the *Robot* rules section in the *Game Manual Part 1*.

Row – There are four (4) *Rows* per *Cryptobox*. Each *Row* is delineated by a strip of 1 inch (2.54 cm) wide, white gaffer tape. The bottom edge of each *Row* is coincident with the bottom edge of a tape strip. A *Row* is *Scored* when there is a *Scored Glyph* in each of the three (3) *Columns* that make up that *Row*.

Safe Zone – The *Area* in front of the *Cryptobox* that is outlined in red or blue gaffer tape. The triangle is 32 inches (81.28 cm) wide at the base and the apex extends 24 inches (61.0 cm) from the wall.

Scoring / Score – *Robots* earn points for their *Alliance* by interacting with *Scoring Elements* and *Parking* in specific *Areas* of the *Playing Field*. *Scoring Elements* are considered to be *Scored* when they are placed in the appropriate location and are no longer in contact with a *Robot* from the corresponding *Alliance*. The *Scoring* achievements and their point values are described in section 1.5.

Scoring Elements – Objects that *Robots* manipulate to earn points for their *Alliance*. The *Scoring Elements* for FIRST® RELIC RECOVERYSM are *Glyphs*, *Relics*, and *Jewels*.

Support / Supported / Completely Supported – A *Robot* is *Supported* by an object if that object is bearing at least some of the weight of the *Robot*. If the object is bearing all the *Robot's* weight, the *Robot* is *Completely Supported* by the object.

Team – Mentors, supporters, and pre-college-aged students affiliated with an entity registered with FIRST and for the competition.

Trap / Trapping – Preventing an opposing *Alliance Robot* escaping from a constrained *Area* of the *Playing Field* or from a *Game Element* for an extended period of time by obstructing ALL paths of travel from the

object or *Area*. See also *Block / Blocking* (which may be considered the same except it is TO a *Game Element* or *Area of the Playing Field*).

1.5 Game Play

Prior to the start of the *Match*, *Drive Teams* perform some basic *Robot* setup steps that are described in section 1.5.1. *Matches* are made up of several periods totaling two minutes and thirty seconds. There is a thirty-second *Autonomous Period*, followed by a two-minute *Driver-Controlled Period*. The last thirty seconds of the *Driver-Controlled Period* is called the *End Game*.

1.5.1 Pre-Match

Field personnel will place all forty-eight (48) *Glyphs* in the *Glyph Pit* and the four (4) *Relics* in the corresponding *Alliance* corners.

Drive Teams receive an *Alliance*-colored *Robot*-identification flag from field personnel; this flag must be securely mounted on the *Robot* as defined in the *Robot* rules. *Drive Teams* place their *Robots* in any orientation on the *Playing Field* with the following constraints:

- 1) *Robots* must start *Balanced* on a *Balancing Stone* of the same color as the *Alliance*, one (1) *Robot* per *Balancing Stone*. The *Balancing Stone* must remain square to the *Playing Field Walls* when the *Robot* is placed. If a *Robot* cannot be *Balanced*, the *Robot* is not eligible to earn points for their *Alliance* during the *Autonomous Period* however it still must start *On* the *Balancing Stone*.
- 2) *Drive Teams* are required to pre-position or pre-load one (1) *Glyph* per *Robot*. *Drive Teams* may choose which color *Glyph* they want to pre-load. Field Personnel will retrieve the *Glyphs* from the *Glyph Pit* and provide them to the *Drive Teams*. *Teams* are not allowed to retrieve *Glyphs* from the *Glyph Pit* themselves. The *Glyph* must be in contact with the *Robot*.

Field personnel will randomize the *Jewels* and *Pictographs* as described in [Appendix G](#).

Once the first *Jewel* or *Pictograph* has been placed:

- 1) *Drive Teams* may no longer touch their *Robots* (including pre-loaded / pre-positioned *Glyphs*) until the conclusion of the *Match*, and
- 2) *Drive Teams* may not touch their *Driver Stations* or *Controllers* until the *Autonomous Period* has ended, except to start their *Autonomous* program with a single touch to the *Driver Station* Android device screen.

1.5.2 Autonomous Period

The *Match* starts with a thirty-second *Autonomous Period* where *Robots* are operated via pre-programmed instructions only. *Teams* are not allowed to control *Robot* behavior with the *Driver Station* or any other actions during the *Autonomous Period*. The *Driver Station* is placed in a hands-off location during the *Autonomous Period* so that it is evident that there is no human control of *Robots*. The only exception is to allow *Drive Teams* to start their *Robot* with a single start command issued on the *Driver Station* Android device using the built-in thirty-second timer. The *Autonomous Period* begins following a start countdown (for example, 3-2-1-go) by field personnel, signaling *Drive Teams* with *Robots* that plan to run an *Autonomous* OpMode to issue a *Robot* start command with their *Driver Station*. Failure to adhere to this procedure may subject the *Team* and/or *Alliance* to a *Penalty* as specified in the game rules in Section 1.6.2.

The *Autonomous Score* is based on the number and locations of *Glyphs* placed in *Cryptoboxes* during the *Period*, the state of the *Jewels*, and location of the *Robots* at the end of the *Period* after all *Game Elements* and *Robots* have come to rest. Points are awarded for the following achievements:

- 1) **Jewels** – The *Jewels* are randomly set up at the start of a *Match*, as described in Appendix G, so that *Robots* must use onboard sensors to identify the correct *Jewel* to remove in favor of their *Alliance* (i.e., *Robots* on the Red *Alliance* will try to remove the blue *Jewel*).

Platforms with a single *Jewel* remaining on them will earn thirty (30) points for the *Alliance* corresponding to the color of the *Jewel*.

- 2) **Glyph In Cryptobox** – Each *Glyph* that is *Scored* into an *Alliance*-specific *Cryptobox* by a *Robot* will earn the corresponding *Alliance* fifteen (15) points regardless of its location or which *Alliance* placed it. See Appendix C and D.
- 3) **Cryptobox Key** – One of the three *Cryptobox Columns* is randomly selected at the start of the *Match* to be the *Cryptobox Key*. *Robots*, using a vision sensor, may decrypt the *Pictograph's* message to reveal which of the three *Columns* is the *Cryptobox Key*. If the first *Glyph Scored* into a *Cryptobox* is placed in the correct *Cryptobox Key Column* (at any height), it earns a thirty (30) point bonus in addition to the fifteen (15) points earned for loading the *Glyph* into the *Cryptobox*. This *Score* is awarded to the *Alliance* corresponding to the *Cryptobox's* color.
- 4) **Robot Parking** – A *Robot Parked In* a *Safe Zone* for their *Alliance* earns ten (10) points.

1.5.3 Driver-Controlled Period

Directly following the end of the *Autonomous Period*, *Drive Teams* have five (5) seconds to pick up their *Driver Stations*. This is followed by a 3-2-1 countdown which signals the beginning of the two-minute *Driver-Controlled Period*.

Drive Teams start their *Robots* by pressing the start button on their *Driver Station* Android device. Failure to adhere to this procedure may subject the *Team* and/or *Alliance* to a *Penalty* as specified in the game rules in Section 1.6.2.

The *Driver-Controlled Score* is based on the number of *Glyphs Scored* into the *Cryptoboxes*, the state of the *Cipher* pattern in each *Cryptobox*, and the locations of the *Relics* and *Robots* at the end of the *Match* after all *Game Elements* and *Robots* have come to rest. At the end of the *Driver-Controlled Period*, points are awarded for the following achievements:

Glyphs Scored into an *Alliance-specific Cryptobox* earn points as follows:

- 1) Each *Glyph Scored* in the *Cryptobox* earns two (2) points for the corresponding *Alliance*.
- 2) Each completed *Row* of *Glyphs* (a *Scored Glyph* in each of the three (3) *Columns* that make up the *Row*) earns ten (10) points.
- 3) Each completed *Column* of *Glyphs* (must have a total of four (4) individual *Glyphs* with a *Scored Glyph* in each of the four (4) *Rows*) earns twenty (20) points.
- 4) A completed *Cipher*, consisting of all twelve (12) individual *Glyphs* in the proper arrangement, earns thirty (30) points.
- 5) Points earned in the *Cryptobox* are cumulative. For instance, if an *Alliance Scores* twelve (12) *Glyphs* into a *Cryptobox* they earn 24 points (2 per *Glyph*) + 40 (10 per *Row*) + 60 (20 per *Column*) for a total of 124 points. If the *twelve (12) Scored Glyphs* form a *Cipher* the *Alliance* will earn a 30-point bonus for a total of 154 points.

1.5.4 End Game

The last thirty seconds of the *Driver-Controlled Period* is called the *End Game*. During the *End Game* *Robots* may reach over the *Perimeter Wall* and *Score* a *Relic* in the *Recovery Zone*. If a *Cryptobox Cipher* is correctly solved prior to the start of *End Game*, *Teams* are permitted to reach over the *Perimeter Wall* and

attempt to Score a *Relic* early. One (1) *Relic* may be Scored early for each completed *Cipher*. Referees will signal the *Alliance* when they are allowed to Score a *Relic*. If a *Cipher* has not been completed, the *Alliance* must wait for the start of the *End Game Period* to score their *Relic*. *Robots* may continue to perform all the other *Driver-Controlled Scoring* activities during the *End Game*. Points are awarded at the end of the *Match* for the following *End Game* achievements:

1. **Relics in the Recovery Zone** – An *Alliance* will earn points for all *Relics* that are *In* their corresponding *Recovery Zone* at the end of the *Match* subject to the following provisions:
 - a. **Zones** – *Relics In Zone 1* earn ten (10) points, *In Zone 2* earn twenty (20) points, *In Zone 3* earn forty (40) points. *Relics* may only earn points for being in one (1) *Zone* at a time. If a *Relic* is touching two (2) *Zones*, points will be awarded for the higher value *Zone*.
 - b. *Relics* that remain upright *In the Recovery Zone* (bottom surface is the only part of the *Relic* that is in contact with the *Relic Recovery Zone*) earn an additional fifteen (15) points per *Relic*.
2. **Robots Balanced on Balancing Stone** – A *Robot* will earn twenty (20) points for being *Balanced* on a *Balancing Stone* at the end of the *Match*. *Robots* may only *Balance* on *Balancing Stones* corresponding to their *Alliance* color.

At the conclusion of the *Driver-Controlled Period*, *Drive Teams* are required to press the “Stop” button on their *Driver Station* Android Device. Failure to press the “Stop” button within a reasonable human reaction time is considered a violation of Rule <G9>.

1.5.5 Post Match

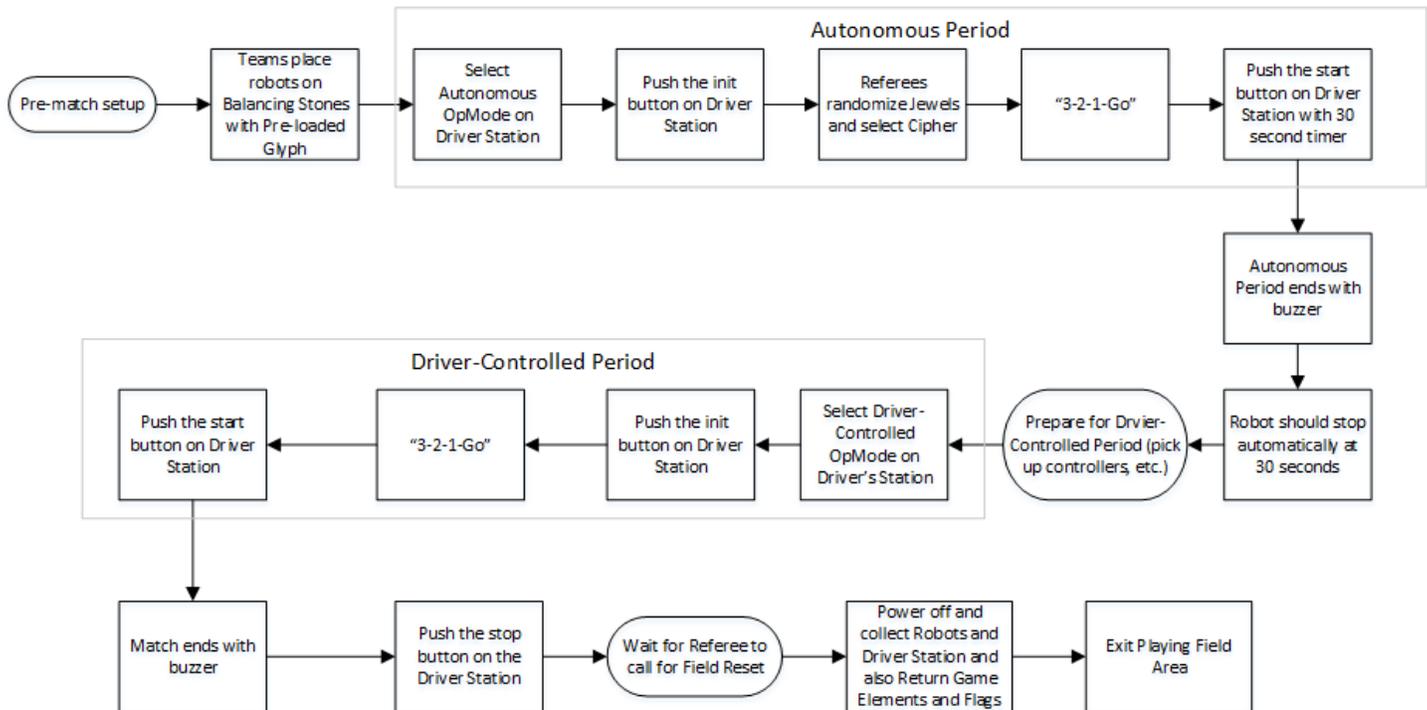
After the *Match*, Score Trackers will complete recording the number of *Glyphs*, *Rows*, *Columns*, and *Ciphers Scored* into *Cryptoboxes*, the state of the *Robots*, and the locations of the *Relics*. After the Score Trackers are finished *Scoring* the *Playing Field*, Referees will signal for the *Drive Teams* to enter the *Playing Field* and retrieve their *Robots*. *Drive Teams* should not step on or over the *Balancing Stones* or the *Recovery Zone* mats when retrieving their *Robots*. The *Drive Teams* should return *Glyphs*, *Jewels*, and *Relics* that are *Possessed* by the *Robot* to the *Playing Field* and return the *Alliance-colored Robot* identification flag to the field personnel. The *Playing Field* reset crew will set up the *Playing Field* for the next *Match*.

1.5.6 Penalty Scoring

Penalty points are added to the non-offending *Alliance’s* *Score* at the end of the *Match*. *Minor Penalties* give the non-offending *Alliance* ten (10) points per occurrence. *Major Penalties* give the non-offending *Alliance* forty (40) points per occurrence.

1.5.7 Flowchart of Match Play

The following figure shows the flow of the *Match* and the actions taken on the *Driver's Station* Android device.



1.6 Rules of Game Play

Game play is restricted by the Safety rules (<S#>), the General rules (<G#>), and the Game-Specific rules (<GS#>). Other rules to pay close attention to are the *Robot* rules, the inspection rules, and the tournament rules defined in the Game Manual Part 1. Violation of rules may lead to *Penalties*, *Yellow Cards* and/or *Red Cards*, a *Disabled Robot*, *Disqualification* of the offending *Team* and/or *Alliance* from either a *Match* or the tournament. Rules apply to all periods of play unless specifically called out otherwise. If rules are in conflict, Safety rules take precedence over all rules and Game-Specific rules take precedence over General rules. The official *FIRST* Tech Challenge Question & Answer Forum rulings take precedence over all information in the game manuals.

1.6.1 Safety Rules

<S1> **Unsafe Robot and Playing Field Damage** – If at any time the *Robot* operation is deemed unsafe or has damaged the *Playing Field* or another *Robot*, by the determination of the referees, the offending *Robot* may be *Disabled* and the *Team* may be issued a *Yellow Card*. Re-inspection of the *Robot* is required before it may play another *Match*.

The intent of this rule is to immediately stop unsafe *Robot* actions or *Playing Field Damage* that is likely to persist with continued *Robot* operation. *Robots* that can continue safe operation without damaging the *Playing Field* will receive a warning and may continue to play the *Match*. *Robots* will be *Disabled* for unsafe operation or *Playing Field Damage* that occurs after the first warning for the tournament.

<S2> Robot Extension Outside the Playing Field Perimeter – If any portion of the *Robot* contacts anything *Outside* the *Playing Field Perimeter*, the *Team* will be issued a *Yellow Card* and it may be *Disabled* immediately for the remainder of the *Match*, unless allowed by Game-Specific rule(s) listed in Section 1.6.3. See the game definitions in section 1.4 for a complete description of the *Playing Field Perimeter*.

The intent of this rule is not to *Penalize* an *Alliance* for *Inadvertent*, safe *Robot* extension *Outside* the *Playing Field Perimeter*. Intentional *Robot* extension *Outside* the *Playing Field* is not permitted, except as allowed by game-specific rules listed in Section 1.6.3.

<S3> Safety Gear – All members of the *Drive Team* are required to wear approved eye protection and shoes with closed-toes and a closed-back. If any member of the *Drive Team* is not wearing these safety items, the referee will issue a warning and if the situation is not remedied within thirty seconds, the offending member(s) of the *Drive Team* must leave the *Competition Area* for the remainder of the *Match* and may not be replaced by another *Team* member. Failure to comply with a request to leave the *Competition Area* violates rule <G27>.

1.6.2 General Game Rules

<G1> Drive Team – Each *Drive Team* shall include up to two *Drivers* and one *Coach*. Electronic communications (cell phone, two-way radio, Wi-Fi, Bluetooth, etc.) by *Drive Team* members after an *Alliance* has been called from the queue to the *Playing Field* for its *Match* are not allowed. The first instance of violating this rule will result in a warning, with any following instances during the tournament resulting in a *Minor Penalty*. Items that may be mistaken by a casual observer as being in violation should not be brought to the *Playing Field*. The *Driver Station* is exempt from this rule, but must be used only for operating the *Robot*.

<G2> Pre-Match Robot Setup – At the beginning of a *Match*, each *Alliance Robot* must be set up on the *Playing Field* in accordance with section 1.5.1. After *Robots* have been set up on the *Playing Field*, *Drive Teams* are required to stand *Completely Inside* the *Alliance Station* at the location (*Station one* or *Station two*) specified by the Qualification *Match* schedule.

- a. During the Qualification *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 *Elimination Matches*, the 3rd and 4th 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 seeding of a *Team* during the *Elimination Matches*. If the 4th seed defeats the 1st seed in the Semi-Finals, they will still have to place their *Robot* on the field first in the Finals because their seeding will be lower than the 2nd or 3rd seed.
- c. *Teams* may implicitly waive their right to place their *Robots* on the *Playing Field* last by placing their *Robots* on the *Playing Field* before or in conjunction with the opposing *Alliance*. There is no need to notify the referees; *Teams* waive their right by the act of placing their *Robots* on the *Playing Field*.
- d. *Teams* that unnecessarily delay the beginning of a *Match* and/or field reset will incur a *Minor Penalty* for each offense.

Drive Teams are expected to stage their *Robots* for a *Match*, and remove them from the *Playing Field* afterwards, safely and swiftly. *Drive Team* efforts that either intentionally or unintentionally delay the start of a *Match* or the *Field* reset are not allowed. Examples include, but are not limited to:

- Late arrival to the *Playing Field*.
- *Robot* maintenance once on the *Playing Field*.

<G3> Robot Starting Volume – Before the start of a *Match*, each *Robot* in its starting location must not exceed a volume of 18 inches (45.7cm) wide by 18 inches (45.7cm) long by 18 inches (45.7cm) tall. The *Alliance* identification flag and pre-loaded *Scoring Elements* may extend *Outside* the 18-inch (45.7cm) cube volume constraint. An offending *Robot* will be *Disabled* and powered off for the *Match* at the Head Referee’s discretion and must remain on the *Playing Field* in its starting location for the length of the *Match*. After the start of a *Match*, the *Robot* may extend in any dimension unless restricted by the Game-Specific rules detailed in Section 1.6.3.

<G4> Robot Setup Alignment Devices – Alignment devices are allowed during *pre-Match* setup if they are constructed from legal components, are part of the *Robot*, and remain *Completely Inside* the 18-inch (45.7cm) cube starting volume constraint during the set up process. A *Minor Penalty* will be assessed to the *Team* for violation of this rule.

The intent of this rule is to prohibit the use of devices external to the *Robot* and to prevent the extension of any object or tool *Outside* the 18-inch (45.7cm) cube starting volume. Humans standing on the other side of the field to aid in aligning the *Robot* are not allowed.

<G5> Alliance Station – During a *Match*, the *Drivers* and *Coach* must remain *Completely Inside* their *Alliance Station*. The first instance of leaving the *Alliance Station* will result in a warning, with any following instances resulting in a *Minor Penalty*. Leaving the *Alliance Station* for safety reasons will not result in a warning or *Penalty*.

<G6> Starting Game Play Early – *Robots* that start play of the game (*Autonomous* or *Driver-Controlled Period*) prior to competition personnel announcing the start of a *Match Period* receive a *Minor Penalty*. Referees have the option of issuing a *Major Penalty* in place of the *Minor Penalty* if the early start results in a competitive advantage for the offending *Alliance*.

<G7> Late Start of the Autonomous Period – *Teams* participating in the *Autonomous Period* are expected to press the “start with 30-second” button on their *Driver Station* Android device and then place the *Driver Station* in a hands-off location without delay when field personnel signal the start of the *Autonomous Period*. A *Minor Penalty* is assessed for violating this rule. Referees have the option of issuing a *Major Penalty* in place of the *Minor Penalty* if the late start results in a competitive advantage for the offending *Alliance*.

<G8> Stopping Autonomous Period Game Play Early – *Drive Teams* that use their *Driver Station* to stop their *Robot* before the end of the *Autonomous Period* will receive a *Major Penalty*. In the case of unsafe *Robot* behavior, the *Drive Team* will not be *Penalized* for stopping the *Robot* if it is performed with the approval of a referee or Field Technical Advisor.

<G9> Stopping Game Play Late – *Robots* that do not stop playing the game at the end of the *Autonomous* or *Driver-Controlled Periods* when competition personnel or timer software announce the end of a *Match* period receive a *Minor Penalty* and the actions of the *Robot* occurring after the end of a *Match* period do not count towards their *Alliance's Score*. Referees have the option of issuing a *Major Penalty* in place of the *Minor Penalty* if the late stop results in a competitive advantage (other than *Scoring*) for the offending *Alliance*.

Scoring Elements that were launched before the end of the period are eligible to be counted as *Scored*. Other *Robot Scoring* achievements that occur after the announced end of the *Autonomous Period* and before the start of the *Driver-Controlled Period* do not count towards the *Score* for the *Autonomous* or *Driver-Controlled Periods*. Referees may remove any *Scoring Elements* from a *Scoring Area* that are improperly *Scored* in this manner.

The intent of this rule is for *Robots* to stop playing the game within a reasonable human reaction time following the start of the game sound (i.e., buzzer) signaling the end of the period. *Drive Teams* should make their best effort to stop game play immediately when the end of period game sound begins. Before the consequences come into play, referees will use their discretion to give *Drive Teams* an approximate one second grace period following the conclusion of the game sound signaling the end of the period for *Robots* to stop playing the game.

<G10> Drive Team Contact with the Playing Field or Robot – During a *Match*, the *Drivers* and *Coaches* are prohibited from making contact with the *Playing Field*, any *Game Element*, or any *Robot*. The first instance of contact will result in a warning, with any following instances resulting in a *Minor Penalty*. Contact that affects *Scoring* and/or game play will result in issuance of a *Yellow Card* at the discretion of the referees. Contact with the *Playing Field*, a *Game Element*, or a *Robot* for safety reasons will not result in a warning or *Penalty*.

For example, a *Game Element* is launched from a *Robot* on the *Playing Field* and it *Inadvertently* hits a *Team* member in the *Alliance Station* and is deflected back onto the field. The *Team* would NOT receive a *Penalty* because the *Team* member was protecting him/herself (safety). However, if that same *Game Element* is caught and/or directed to a specific location on the *Playing Field*, the *Team* may be issued a *Penalty*.

<G11> Autonomous to Driver-Controlled Period Transition – At the conclusion of the *Autonomous Period*, *Robots* will remain in a hands-off state. Field personnel will not enter the field, and will not touch *Robots* on the field from the *Autonomous* to *Driver Controlled* transition.

Important Note: Rule <G11> is a major change for the 2017-2018 season. Volunteers, Coaches and Teams must be prepared for this new transition during the competition season.

<G12> Drive Team Coach Driver Station Control – During the *Driver-Controlled Period*, *Robots* must be remotely operated only by the *Drivers* using the Gamepads connected to the *Team's Driver Station* and/or by software running in the on-board *Robot* control system. The first instance of *Coach* controlling a *Robot* (for example, operating a Gamepad) will result in a warning, with any following instances resulting in a *Major Penalty*. During the *Driver-Controlled Period*, *Drive Team Coaches* and/or *Drivers* are allowed to hold the

Team's Driver Station Android device and interact with it to select an Op Mode, view information displayed on the screen, and initialize, start, stop, and reset the *Robot*.

<G13> Recording the Scores During the Match/After Objects Come to Rest – Scoresheets will be filled out by the Score Trackers throughout the *Autonomous* and *Driver-Controlled Periods* of the *Match*. At the conclusion of the *Match*, the final *Score* will be recorded once all elements have come to rest. A change in state of a *Game Element* or *Robot* after its *Score* is recorded on the scoresheet will not change an already-recorded *Score*.

<G14> Robots Deliberately Detaching Parts – *Robots* may not deliberately detach parts during a *Match*, or leave mechanisms on the *Playing Field*. The consequence of deliberately detaching a part is a *Minor Penalty* if it does not *Block* an opposing *Alliance Robot*, *Alliance-specific Scoring Element* or *Scoring Area*. If a deliberately-detached component or mechanism affects gameplay by any *Robot*, the offending *Robot* will receive a *Major Penalty* and will be issued a *Yellow Card*. *Robot* parts that are released but remain connected by a tether are considered detached for the purposes of this rule.

Tethered components that move independent of the main *Robot* are considered a detached component and are illegal.

<G15> Robots Grasping Game Elements – *Robots* may not grab, grasp and/or attach to any *Game Element* or structure other than *Scoring Elements*, unless specifically allowed by game-specific rule(s) listed in Section 1.6.3. The first instance will result in a warning with any following violations resulting in a *Major Penalty*.

<G16> Destruction, Damage, Tipping, etc. – Strategies and/or mechanisms aimed solely at the destruction, damage, tipping over, or entanglement of *Robots* or *Game Elements* are not in the spirit of the *FIRST* Tech Challenge and are not allowed. However, *FIRST* Tech Challenge games are highly interactive and *Robot-to-Robot* contact and defensive game play should be expected. Some tipping, entanglement, and damage may occur as a part of normal game play. If the tipping, entanglement, or damage is ruled to be deliberate or chronic, the offending *Team* will receive a *Major Penalty* and a *Yellow Card*.

<G17> Pinning, Trapping, or Blocking Robots – A *Robot* cannot cause an opposing *Alliance Robot* to become *Pinned*, *Trapped*, or *Blocked* for more than five seconds. If a referee determines this rule is violated, the offending *Alliance* will receive a *Minor Penalty* for every five seconds that they are in violation. If a referee declares a *Pinning*, *Trapping*, or *Blocking* warning during the *Match*, the offending *Robot* must immediately move away at least 3 feet (0.9 m), approximately 1.5 floor tiles, from the *Pinned*, *Trapped*, or *Blocked Robot*.

The intent of this Rule is that *Drive Teams* begin to immediately move their *Robots* away and have a five second grace period to move the required distance, and NOT that they are permitted to intentionally *Block* for up to five seconds.

A *Robot* cannot incur this type of *Penalty* during the *Autonomous Period* unless it is determined by the Referee to be part of a deliberate strategy and will be penalized as described above. If the violation happens during the *Autonomous Period*, the first action done by the offending *Robot* during the *Driver-Controlled Period* must be to move away from the *Pinned*, *Trapped*, or *Blocked Robot* or a *Minor Penalty* will

be assessed immediately and again for every five seconds that they are in violation. Game-specific rule(s) listed in Section 1.6.3 that further define *Pinning, Trapping, or Blocking* take precedence over this general game rule.

<G18> Forcing an Opponent to Break a Rule – The actions of an *Alliance* or their *Robots* shall not cause an opposing *Alliance* or *Robot* to break a rule and thus incur *Penalties*. Any forced rule violations committed by the affected *Alliance* shall be excused, and no *Penalties* will be assigned.

<G19> Removing Game Elements from the Playing Field – *Robots* may not deliberately remove *Game Elements* from the *Playing Field* during a *Match*. *Game Elements* that *Inadvertently* fall *Outside* the *Playing Field* will be returned to the *Playing Field* by field personnel at the earliest safe and convenient opportunity at a non-*Scoring* location approximately where it left the field. *Game Elements* removed from the *Playing Field* in an attempt to *Score* are also not subject to this *Penalty*. *Teams* deliberately removing *Game Elements* from the *Playing Field* will incur a *Minor Penalty* per *Game Element* removed from the *Playing Field*. Game-specific rule(s) listed in Section 1.6.3 that allow the removal of specified *Scoring Elements* from the *Playing Field* take precedence over this general game rule.

<G20> Scoring Elements in Contact with Robots – *Scoring Elements* in a *Scoring Area* that are in contact with a *Robot* on the corresponding *Alliance* for the *Scoring Area* have zero *Score* value when *Score Trackers* record the *Score* at the end of the *Autonomous* and *Driver-Controlled Periods*. Game-specific rule(s) listed in Section 1.6.3 that allow *Robot* contact with *Scoring Elements* take precedence over this general game rule.

<G21> Post-Match Removal of Game Elements from Robots – *Robots* must be designed to permit easy removal of *Game Elements* from any grasping, containing, or holding mechanism after the *Match*. *Robots* should also be able to be removed from the *Playing Field* without damaging the *Playing Field*. A *Minor Penalty* will be assessed for violations of this rule.

The intent of this rule is to have timely removal of *Robots* from the *Playing Field* following a *Match*.

Drive Teams are expected to stage their *Robots* for a *Match*, and remove them from the *Playing Field* afterwards, safely and swiftly. *Drive Team* efforts that either intentionally or unintentionally delay the start of a *Match* or the *Field* reset are not allowed. Examples include, but are not limited to:

- Failing to exit the *Playing Field* once instructed by a *Referee*.
- Failing to remove *Driver Stations* in a timely manner.

<G22> Robot Manipulation of Scoring Elements – *Scoring Elements* that are *Controlled* or *Possessed* by a *Robot* are considered to be part of the *Robot*.

<G23> Robot or Scoring Elements In Two or More Scoring Areas – *Robots* or *Scoring Elements* that are *In* two or more *Scoring Areas* earn points only for the highest value achievement. If the achievement values are equal, only one achievement counts as *Scored*. Exceptions to this general rule may be specified in the *Game Play* section (1.5) or in the game-specific rules.

<G24> Disabled Robot Eligibility - If a referee *Disables* a *Robot*, it will not be eligible to *Score* or earn points for the remainder of the *Match*. A *Disabled Robot* (whether referee induced or failure) does not earn penalties after becoming *Disabled*.

<G25> Playing Field Tolerances – *Playing Field* and *Game Elements* will start each *Match* with tolerances that may vary by as much as +/-1.0 inch (2.5 cm). *Teams* must design their *Robots* accordingly.

<G26> Match Replay – *Matches* are replayed at the discretion of the Head Referee only for a failure of a *Game Element* or verified Wi-Fi interference that was likely to have impacted which *Alliance* won the *Match*.

Unexpected *Robot* behavior in itself will not result in a *Match* replay. *Team*-induced failures, such as low battery conditions, processor sleep time-outs, *Robot* mechanical/electrical/software/communication failures, etc. are NOT valid justifications for a replaying of a *Match*.

<G27> Egregious Behavior – Egregious *Robot* or *Team* member behavior at the *Playing Field*, as determined by the referees, will result in a *Major Penalty* and issuance of a *Yellow Card* and/or *Red Card*. Subsequent violations will result in *Team Disqualification* from the tournament. Egregious behavior includes, but is not limited to, repeated and/or flagrant violation of game rules, unsafe behavior or actions, use of game or field elements to amplify the difficulty of scoring activities, and uncivil behavior towards *Drivers*, *Coaches*, competition personnel, or event attendees.

<G28> Inadvertent and Inconsequential - *Robot* actions that violate a rule may be ruled at the referee's discretion to be *Inconsequential* and *Inadvertent* and will not be *Penalized*.

1.6.3 Game-Specific Rules

<GS1> Drive Teams Touching Robots or Driver Stations after Jewel/Pictograph Randomization – *Drive Teams* are not allowed to touch or interact with their *Robots* or *Driver Stations* once field personnel have begun the randomization process. If this occurs, a *Minor Penalty* will be assessed per *Robot* and the affected *Robots* are not eligible to *Score* a *Jewel/Cryptobox Key* in the *Autonomous Period*. This *Penalty* only affects the offending *Team*. The non-offending *Alliance Partner Robot* remains eligible for the *Jewel/Cryptobox Key Scoring* achievement.

<GS2> Autonomous Period Robot Keep Out Area – *Robots* may not go *Inside* the opposing *Alliance's Area* of the *Playing Field* at any time during the *Autonomous Period*. A *Major Penalty* will be assessed for violating this rule and any *Scoring* that occurs in the opposing *Alliance's Area* by the offending *Robot* will not benefit the offending *Alliance*. The red and blue gaffer tape on the *Playing Field Floor* divides the *Playing Field* into equal sized *Alliance Areas*. *Robots* may enter the *Glyph Pit* at any time.

The intent of this rule is to allow *Robots* to *Score* their *Jewels* and *Glyphs* without defensive play by the opposing *Alliance*. *Inadvertent* and *Inconsequential* incursions will be treated per <G28>.

<GS3> Control/Possession Limits of Glyphs – Once a *Match* begins, a *Robot* may *Control* or *Possess* a maximum of *two (2) Glyphs*. Plowing through any quantity of *Glyphs* is allowed but herding or directing multiple *Glyphs* to gain a strategic advantage (i.e., *Scoring*, accessibility, defense) is not allowed. The *Penalty* for *Controlling* or *Possessing* more than two (2) *Glyphs* is an immediate *Minor Penalty* for each *Glyph* above the limit plus an additional *Minor Penalty* per *Glyph* for each 5-second interval that this situation continues. A double *Major Penalty* will be assessed for each *Glyph Scored* while a *Robot Controls* or *Possesses* more than two (2) *Glyphs*. Continued violation of this rule will escalate to *Yellow Cards* quickly.

<GS4> Glyph Hoarding – Once an alliance has successfully scored more than 20 *Glyphs*, the members of the *Alliance* may not collectively possess/control/block access to more than the number of *Glyphs* required for the *Alliance* to completely fill their *Cryptoboxes*. Violation of this rule will result in an immediate *Major Penalty* and an additional *Minor Penalty* assessed for each 5 seconds the rule violation persists per *Glyph* in excess of the limit. Intentional or repeated violations of this rule will escalate quickly to issuance of *Yellow Cards* to all members of the *Alliance*.

<GS5> Control/Possession Limits of Relics – Once a *Match* begins, a *Robot* may *Control* or *Possess* a maximum of one *Relic* at a time. The *Penalty* for *Controlling* or *Possessing* more than one *Relic* is that no *Relics* will be eligible to be *Scored* at the end of the *Match* by either *Robot* for the *Alliance*.

<GS6> De-scoring Glyphs – *Robots* may not remove or re-position *Glyphs* from their opposing *Alliance's* *Cryptoboxes*. A *Double Major Penalty* will be assessed for every *Glyph* illegally removed or re-positioned. *Robots* are allowed to remove or re-position *Glyphs* from their own *Alliance's* *Cryptoboxes*.

Drive Teams should exercise care when operating around an opposing *Alliance's* *Cryptobox* to mitigate *De-scoring*.

<GS7> De-scoring Relics – *Robots* may not remove or re-position *Relics* *In* the opposing *Alliance's* *Recovery Zone*. In the event of any re-positioning (for example, if a *Blue Relic* is dropped into the *Blue Recovery Zone*, bounces to the *Red Recovery Zone* and knocks the *Red Relic* from one *Scoring* position to another) the opposing *Alliance's* *Relic* is awarded the maximum potential points (40 + 15 = 55).

De-scoring an opposing *Alliance's* *Relic* will be penalized, even if it is accidental. This rule supersedes rule <G28>.

<GS8> Interfering with Access to Cryptobox – *Robots* may not interfere with an opposing *Alliance Robot* that is *In* their *Alliance's* *Safe Zone* and attempting to *Score* a *Glyph*. A *Robot* must have a *Glyph* in its *Control* to be considered as attempting to *Score*. The first instance will result in an immediate *Major Penalty* and an additional *Minor Penalty* assessed for every five seconds that the rule violation persists. Additional occurrences of violations of this rule will escalate to *Yellow Cards* quickly.

<GS9> Non-Glyph Game Elements Inside Cryptobox – *Glyphs* are the only item allowed to be placed *In* a *Cryptobox*. A *Major Penalty* will immediately be assessed for each non-*Glyph* item (*Jewel*, *Relic*, etc.) placed *In* an opposing *Alliance's* *Cryptobox*. Removal of the illegal *Game Element* is up to the *Alliance* that owns the *Cryptobox*.

<GS10> Controlling or Blocking access to Relics - *Robots* may not *Control*, *Trap*, or *Block* access to an opposing *Alliance's* *Relic*. The first instance will result in an immediate *Major Penalty* and an additional *Minor Penalty* assessed for every five seconds that the rule violation persists. If the referee declares a *Controlling*, *Trapping*, or *Blocking* access *Penalty*, the offending *Robot* must move away at least 3 ft. (0.9 m), approximately 1.5 floor tiles from the opponent's *Relic*. Additional occurrences of violations of this rule will escalate to *Yellow Cards* quickly.

The intent of this rule is to allow *Robot* access to their *Relics*. *Blocking* means denying ALL access, so general *Robot* movement with respect to other *Robots* should not be considered in violation unless there is no other way to traverse the *Playing Field* to get the *Relic*. Also, note that this rule requires attempted action on the part of the opposing *Alliance*.

<GS11> Blocking access to Balancing Stone– During the *End Game*, *Robots* may not *Block* access to the opposing *Alliance's* *Balancing Stones*. The first instance will result in a warning with any following violations resulting in a *Major Penalty* and an additional *Minor Penalty* assessed for every five seconds that the rule violation persists. If the referee declares a *Blocking* access warning during the *End Game*, the offending *Robot* must move away at least 3 feet (0.9 m), approximately 1.5 floor tiles from the *Blocked Balancing Stone*. Failure to move the required 3 feet (0.9 m) within 5 seconds is considered an additional violation and will incur the penalties described above. Additional occurrences of violations of this rule will escalate to *Yellow Cards* quickly.

The intent of this rule is to allow *Robot* access to and from their *Alliance's Balancing Stones*. *Blocking* and *Trapping* means denying ALL access, so general *Robot* movement with respect to other *Robots* should not be considered in violation unless there is no other way to traverse the *Playing Field* to get to the *Balancing Stone*. Also note that this rule requires attempted access to a *Balancing Stone* on the part of the opposing *Alliance*.

<GS12> Balancing Stone Interference – *Robots* may not interfere with the opposing *Alliance's Robot* or *Balancing Stone* while that *Robot* is attempting to *Balance* during the *End Game*. Once a *Robot* is in contact with the *Balancing Stone* this rule will apply. The first instance will result in a warning with any following violations resulting in a *Major Penalty* and an additional *Minor Penalty* assessed for every five seconds that the rule violation persists. The intent of this rule is to allow *Robots* to *Balance* on the *Balancing Stones* without interference. Additional occurrences of violations of this rule will escalate to *Yellow Cards* quickly.

<GS13> Preventing Relic Scoring – *Robots* may not interfere with opposing *Alliance Robots* that are attempting to *Score* a *Relic*. A *Robot* must have a *Relic* in its *Possession* and be within 24 inches (61 cm), approximately one tile, of the wall facing that *Alliance's Recovery Zones* to be considered as attempting to *Score*. Incidental contact that is *Inadvertent* and *Inconsequential* will not be *Penalized*. The first instance will result in a *Major Penalty* and an additional *Minor Penalty* assessed for every five seconds that the rule violation persists.

<GS14> Relic Control - *Robots* may *Control* or *Possess* their own *Alliance's Relics* at any time but may only *Score* their *Relic* (i.e. reach over the *Playing Field Wall*) during the *End Game* or when the *Relic* is eligible to be *Scored* (whichever is earlier). If a *Cryptobox Cipher* is correctly solved prior to the start of *End Game*, *Teams* are permitted to *Score* their *Relic* early. One (1) *Relic* may be *Scored* early for each completed *Cipher*. Referees will signal the *Alliance* when they are allowed to *Score* a *Relic* early. *Relics* that are moved *Outside* the *Playing Field Wall* (by their *Alliance*) before they are eligible will have zero *Score* value.

<GS15> Outside Contact during Relic Scoring – *Robots* may reach over the audience-facing *Playing Field Perimeter Wall* (and touch the floor outside the *Playing Field*) only while attempting to *Score* or attempting to re-position a *Relic*.

Robots may contact the top and outside surface of the *Playing Field Perimeter Wall* as well as the *Recovery Zone* mats while attempting to *Score* a *Relic*. *Robots* extending *Outside* the *Playing Field* and *Relics* removed from the *Playing Field* in an attempt to *Score* are not subject to rule <S2> or <G19>. For example, a *Robot* reaching over the wall while attempting to score a *Relic* in the *Recovery Zone* is allowed. Note that rule <S1> still applies, so *Robots* will need to ensure safe behavior when extended *Outside* the *Playing Field Wall*.

<GS16> Scoring Relics - The only legal way to *Score* a *Relic* is by placing/dropping it in the *Relic Recovery Zone*. *Relics* may not be propelled with any noticeable force (i.e. shooting, launching, flicking, etc.). Illegally launched *Relics* have zero *Score* value. *Relics* that miss the *Recovery Zones* are not replaced into the *Playing Field*. They remain where they land and are available for *Robots* to attempt recovery.

1.7 Scoring Summary

The following table shows the possible *Scoring* achievements and their point values. The table is a quick reference guide and not a substitute for a thorough understanding of the game manual.

Scoring Achievement	Autonomous Points	Driver-Controlled Points	End Game Points**	Reference
<i>Jewels</i> - One <i>Jewel</i> remains on the Platform	30 points	-	-	1.5.2.1
<i>Relic</i> - In Zone 1 - In Zone 2 - In Zone 3 - Upright Bonus	- - - -	- - - -	10 20 40 15	1.5.4.1
<i>Glyph</i> - Scored in Cryptobox - Bonus for a correct Cryptobox Key - Completed Row of 3 - Completed Column of 4 - Completed Cipher	15 30	2 - 10 per Row 20 per Column 30 points		1.5.2 and 1.5.3
<i>Robot Parked</i> - In Safe Zone	10	-		1.5.2.4
<i>Robot Balanced</i>	-	20		1.5.4.2

** - The *End Game* occurs during the last thirty seconds of the *Driver-Controlled* Period.

1.8 Rule Summary

The following table shows the possible rule violations and their consequences. The table is a quick reference guide and NOT a substitute for a thorough understanding of the complete rule descriptions in section 1.6.

Rule #	Rule	Consequence	Warning Disable	Minor Penalty	Major Penalty	Card Issued
Safety Rules						
<S1>	Unsafe Robot.	Disable if unsafe operation is likely to persist. Optional <i>Yellow Card</i> .	D			YC*
	Damage to the <i>Playing Field</i> .	Warning escalating to <i>Disable</i> .	W D			YC*
<S2>	Contact Outside the <i>Playing Field</i> .	<i>Immediate Yellow Card</i> . Optional <i>Disable</i> unless allowed by rule.	D*			YC
<S3>	<i>Drive Team</i> missing safety gear.	Warning and if not resolved within 30 seconds, the offending member(s) of the <i>Drive Team</i> must leave the <i>Competition Area</i> and may not be replaced.	W+			
General Rules						
<G1>	<i>Drive Team</i> using disallowed electronic communication.	Warning followed by a <i>Minor Penalty</i> .	W	1x		

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Rule #	Rule	Consequence	Warning Disable	Minor Penalty	Major Penalty	Card Issued
<G2>	<i>Pre-Match Robot</i> setup – Deliberately delaying the start of the <i>Match</i> .	<i>Minor Penalty</i> for each offense.		1x		
<G3>	<i>Robot</i> starting volume.	<i>Robot</i> is <i>Disabled</i> and powered off in a valid starting <i>Area</i> on the <i>Playing Field</i> .	D			
<G4>	Illegal <i>Robot</i> setup alignment devices.	<i>Minor Penalty</i> for each offense.		1x		
<G5>	<i>Drive Team</i> member(s) leaving the <i>Alliance Station</i> .	Warning for the first instance with any following instances resulting in a <i>Minor Penalty</i> .	W	1x		
<G6>	Starting Game Play Early.	<i>Minor Penalty</i> with the option of a <i>Major Penalty</i> if the early start results in a competitive advantage for the offending <i>Alliance</i> .		1x	1x	
<G7>	Late <i>Start of the Autonomous Period</i> .	<i>Minor Penalty</i> with the option of a <i>Major Penalty</i> if the late start results in a competitive advantage for the offending <i>Alliance</i> .		1x	1x	
<G8>	Stopping Autonomous Game Play Early.	<i>Major Penalty</i> unless it is done with referee or Field Technical Advisor approval.			1x	
<G9>	Stopping Game Play Late.	<i>Minor Penalty</i> and the actions of the <i>Robot</i> that occur after the end of game play do not count towards their <i>Alliance's Score</i> . <i>Major Penalty</i> if the late stop results in a competitive advantage other than <i>Scoring</i> .		1x	1x	
<G10>	<i>Drive Team</i> contact with the <i>Playing Field</i> or <i>Robot</i> .	Warning for the first instance with any following instances resulting in a <i>Minor Penalty</i> . Contact for safety reasons will not result in a warning or Penalty. Optional <i>Yellow Card</i> if contact affects <i>Scoring</i> and/or game play.	W	1x		YC*
<G11>	<i>Autonomous to Driver-Controlled Period</i> transition – <i>Robot</i> failure.	A <i>Robot</i> that cannot be controlled by the <i>Drive Team</i> will be <i>Disabled</i> and remain in place for the remainder of the <i>Match</i> .	D			
<G12>	<i>Drive Team Coach Driver Station</i> Control.	Warning for the first instance with any following instances resulting in a <i>Major Penalty</i> .	W		1x	
<G14>	<i>Robots</i> deliberately detaching parts.	<i>Minor Penalty</i> , <i>Major Penalty</i> and a <i>Yellow Card</i> if it affects gameplay.		1x	1x	YC
<G15>	<i>Robots</i> illegally grasping <i>Game Elements</i> .	Warning for the first instance with any following instances resulting in a <i>Major Penalty</i> .	W		1x	

Rule #	Rule	Consequence	Warning Disable	Minor Penalty	Major Penalty	Card Issued
<G16>	Destruction, damage, tipping, etc.	Deliberate or chronic violations of this rule will receive a <i>Major Penalty</i> and a <i>Yellow Card</i> .			1x	YC
<G17>	<i>Pinning, Trapping, or Blocking</i> for more than 5-seconds in the <i>Driver-Controlled Period</i> .	<i>Minor Penalty</i> for every five seconds the <i>Robot</i> violates this rule.		1x+		
<G19>	Deliberately removing <i>Game Elements</i> from the <i>Playing Field</i> .	<i>Minor Penalty</i> per <i>Game Element</i> removed from the <i>Playing Field</i> .		1x		
<G20>	<i>Scoring Elements</i> in contact with <i>Robots</i> of the corresponding <i>Alliance</i> .	Points are not earned for any <i>Scoring Elements</i> in contact with <i>Robots</i> of the corresponding <i>Alliance</i> .				
<G21>	Delay caused by removal of <i>Robots</i> from the <i>Playing Field</i> and <i>Game Elements</i> from <i>Robots</i> .	A <i>Minor Penalty</i> will be assessed.		1x		
<G27>	Egregious behavior.	<i>Major Penalty</i> and a <i>Yellow Card</i> and/or <i>Red Card</i> . Possible <i>Match Disqualification</i> . Subsequent violations result in <i>Team Disqualification</i> for the tournament.			1x	YC RC
Game-Specific Rules						
<GS1>	<i>Drive Teams</i> touching <i>Robots</i> or <i>Driver Stations</i> after <i>Jewel / Pictograph</i> randomization.	<i>Minor Penalty</i> plus that <i>Team</i> not eligible to <i>Claim a Jewel/Crypto Key bonus</i> during the <i>Autonomous Period</i> .		1x+		
<GS2>	<i>Robot</i> enters opposing <i>Alliance Area</i> during <i>Autonomous</i> .	<i>Major Penalty</i> is assessed. No benefit for <i>Scoring</i> activity in opponent <i>Area</i> .			1x	
<GS3>	<i>Controlling</i> more than two (2) <i>Glyphs</i> .	<i>Minor Penalty</i> plus additional <i>Minor</i> every 5 seconds per <i>Glyph</i> .		1x+		
	<i>Scoring</i> while <i>Possessing</i> more than two (2) <i>Glyphs</i> .	<i>Double Major Penalty</i> plus additional <i>Minor</i> every 5 seconds per <i>Glyph</i> . May lead to <i>Yellow Card</i> .			2x	YC*
<GS4>	<i>Glyph Hoarding</i>	<i>Major Penalty</i> plus additional <i>Minor</i> every 5 seconds per <i>Glyph</i>			1x	YC*
<GS5>	<i>Controlling</i> or <i>Possessing</i> more than one (1) <i>Relic</i> .	Zero <i>Score</i> value for all <i>Relics</i> of the offending <i>Alliance</i> .				
<GS6>	<i>De-scoring</i> opposing <i>Alliance Glyph</i> .	<i>Double Major Penalty</i> is assessed for each <i>Glyph</i> removed.			2x	
<GS7>	<i>De-Scoring</i> opposing <i>Alliance Relic</i> .	Opposing <i>Alliance</i> gets full value of <i>Relic</i> .				
<GS8>	Interfering with access to the opposing <i>Alliance's Cryptobox</i> .	<i>Major Penalty</i> plus additional <i>Minor Penalties</i> per 5 seconds in violation. May lead to <i>Yellow Card</i> .		1x+	1x	YC*

Rule #	Rule	Consequence	Warning Disable	Minor Penalty	Major Penalty	Card Issued
<GS9>	<i>Non-Glyph Game Elements Inside Cryptobox.</i>	<i>Major Penalty</i> per illegal Game Element.			1x	
<GS10>	<i>Controlling or Blocking access to Opposing Alliance's Relics during End Game.</i>	<i>Major Penalty</i> plus additional <i>Minor Penalties</i> per 5 seconds in violation. More occurrences of violations of this rule will escalate to <i>Yellow Cards</i> quickly.		1x+	1x	YC*
<GS11>	<i>Blocking access to Opposing Alliance's Balancing Stone.</i>	<i>Warning</i> for the first instances with any following instances resulting in a <i>Major Penalty</i> plus additional <i>Minor Penalties</i> per 5 seconds in violation. More occurrences of violations of this rule will escalate to <i>Yellow Cards</i> quickly.	W	1x+	1x	YC*
<GS12>	<i>Balancing Stone Interference.</i>	<i>Warning</i> for the first instance with any following instances resulting in a <i>Major Penalty</i> plus additional <i>Minor Penalties</i> per 5 seconds in violation. More occurrences of violations of this rule will escalate to <i>Yellow Cards</i> quickly.	W	1x+	1x	YC*
<GS13>	<i>Preventing Relic Scoring.</i>	<i>Major Penalty</i> plus additional <i>Minor Penalties</i> per 5 seconds in violation.		1x+	1x	
<GS14>	<i>Relic Scoring</i> permitted in <i>End Game</i> or completed <i>Cipher</i> .	<i>Scoring Relics</i> early will have zero <i>Score</i> value.				
<GS15>	<i>Launching or Shooting Relics.</i>	Zero <i>Score</i> value for <i>Relic</i> .				

Column Key	
W: Warning	1x: <i>Penalty</i> at normal (single) cost
D: Robot Disabled	2x: <i>Penalty</i> at double cost
YC: <i>Yellow Card</i> issued	Pts: Points that would have counted without violation
RC: <i>Red Card</i> issued	+: indicates more than one may be issued if violation persists
*: indicates optionally issued penalties	

Appendix A – Resources

Game Forum Q&A

<http://ftcforum.usfirst.org/forum.php>

Anyone may view questions and answers within the *FIRST*® Tech Challenge Game Q&A forum without a password. To submit a new question, you must have a unique Q&A System User Name and Password for your team.

FIRST Tech Challenge Game Manuals

Part 1 and 2 - <http://www.firstinspires.org/node/4271>

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[FIRST Tech Challenge Team Email Blasts](#) – contain the most recent *FIRST* Tech Challenge news for Teams.

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Feedback

We strive to create support materials that are the best they can be. If you have feedback about this manual, please email ftcteams@firstinspires.org. Thank you!

Appendix B – Vision Patterns for *Pictographs*

Pictographs will be placed adjacent to each *Jewel* platform to provide information to the *Robots* about the *Cryptobox Key* – the *Column* worth bonus points during the *Autonomous Period*. *Teams* are encouraged to use the *Pictographs* and Vuforia™ Navigation software, which is part of the default application library software available from *FIRST* Tech Challenge, to enhance their *Robot's* autonomous navigation accuracy.

Thumbnail size images for the three (3) *Pictographs* are shown below. The images will be printed on 8.5 inch x 11 inch paper (21.6 cm x 27.9 cm). They are available to download from the *FIRST* website:

<http://www.firstinspires.org/resource-library/ftc/game-and-season-info>

The printing and placement instructions for the images are contained in the AndyMark Field Setup Guide that is available for download from the same webpage that hosts the image files.



When this *Pictograph* is placed on the field the first *Glyph* Scored into a *Cryptobox* during the *Autonomous Period* must be Scored into the **Left Column** to earn the *Cryptobox Key* bonus.



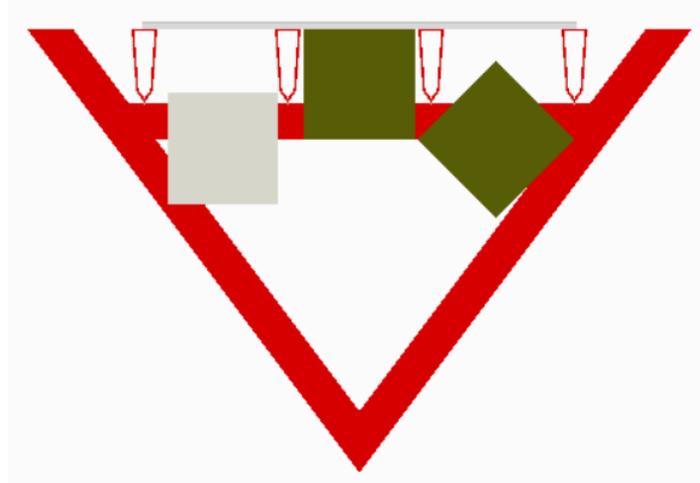
When this *Pictograph* is placed on the field the first *Glyph* Scored into a *Cryptobox* during the *Autonomous Period* must be Scored into the **Center Column** to earn the *Cryptobox Key* bonus.



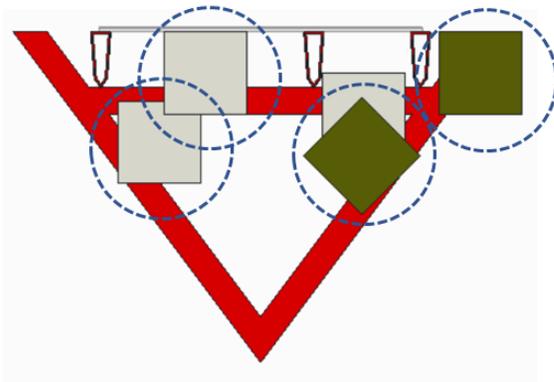
When this *Pictograph* is placed on the field, the first *Glyph* Scored into a *Cryptobox* during the *Autonomous Period* must be Scored into the **Right Column** to earn the *Cryptobox Key* bonus.

Appendix C – Glyph Scoring

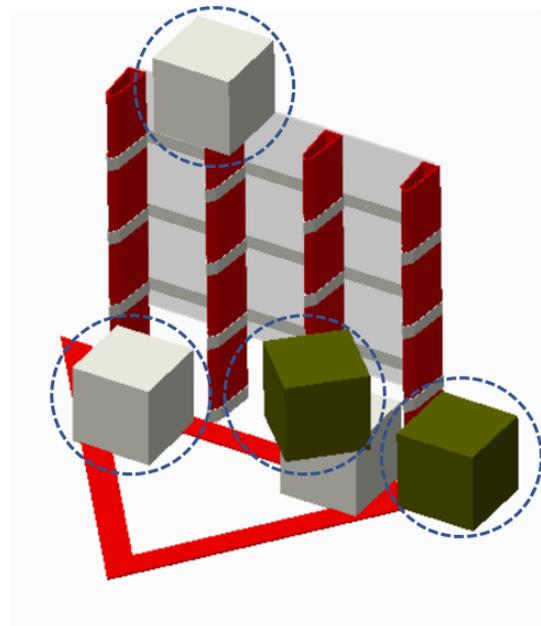
For a *Glyph* to *Score*, some portion of the *Glyph* must be between two *Rails* (the side of the *Rail*, not the top surface) and not in contact with a *Robot* of that *Alliance*. A 2-inch wide strip of tape on the *Playing Field Floor* at the tips of the *Rails* provides a visual aid to help determine if a *Glyph* is between the *Rails*.



Scored Glyphs



Top View



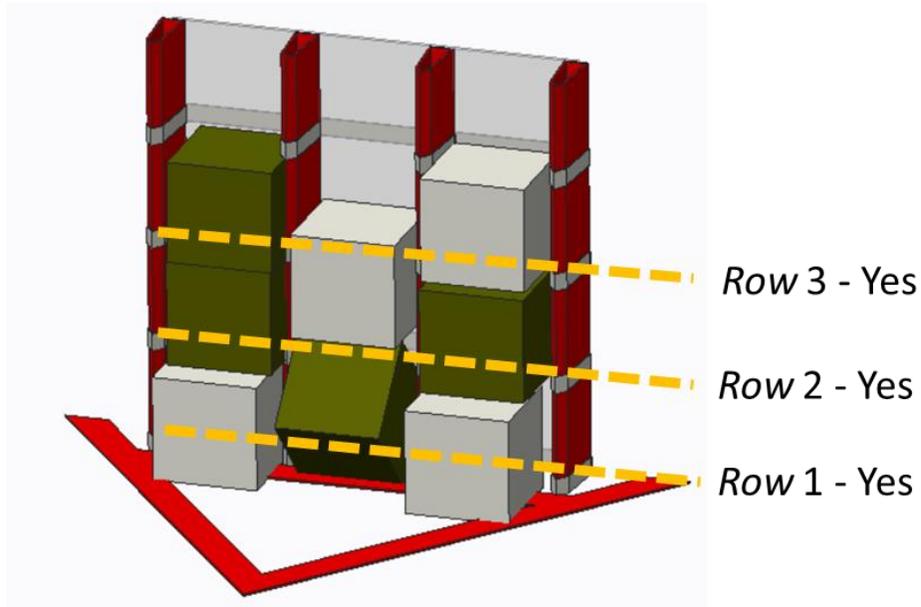
Side View

The circled *Glyphs* are not *Scored* because no portion of the *Glyph* lies between two *Rails*.

Appendix D – Row and Column Scoring

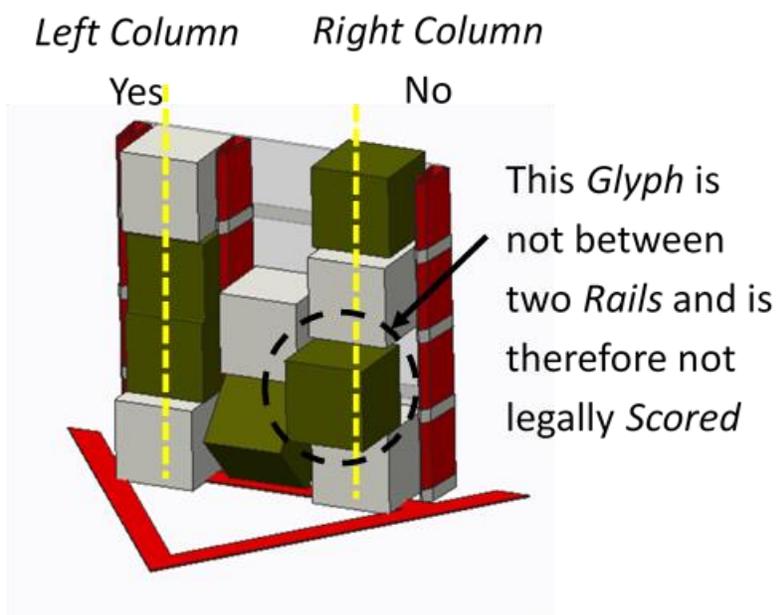
The bottom edge of the 1 inch wide white tape on the *Cryptobox Rails* is coincident with the bottom edge of a *Row*. A *Glyph* that crosses over the bottom edge of the tape is considered to be in multiple *Rows*.

Scored Rows

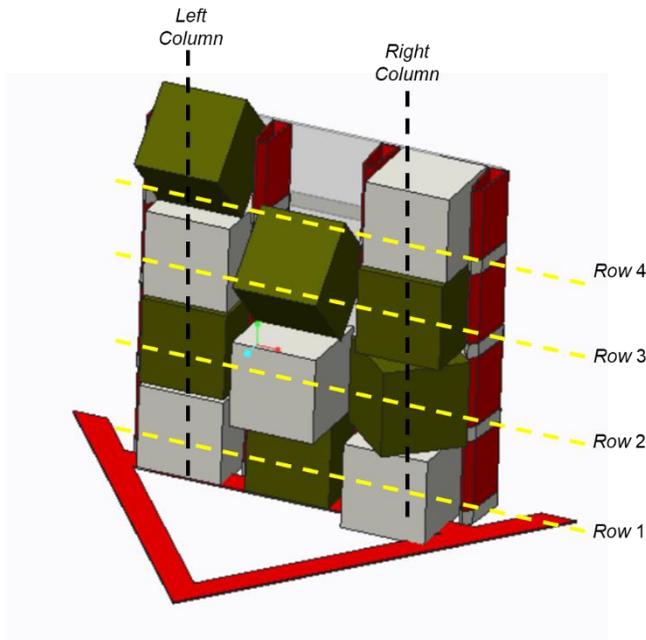


To earn the *Column* bonus, there must be four *Glyphs* in a *Column* and a legally *Scored Glyph* in each *Row* of the *Column*.

Scored Columns



In this Scoring example, the Red Alliance earns:



Rows:	4 x 10 =	40 points
Columns:	2 x 20 =	40 points
Glyphs:	11 x 2 =	22 points
Cipher:	0 x 30 =	0 points
Total Score:	=	102 points

- The Red Alliance did not earn the *Cipher Score* because there are not 12 *Glyphs* in the *Cryptobox* nor is it a valid *Cipher*.
- Red has earned four (4) *Row Scores* because the topmost brown *Glyph* in the *Center Column* extends into the top *Row*.
- Red does not earn the *Center Column Score* because there are only three (3) *Scored Glyphs* in that *Column*.

Appendix E – Ciphers

If an *Alliance* Scores twelve (12) *Glyphs* into a *Cryptobox* in the proper arrangement to form any one of the six (6) *Ciphers* shown below, then the *Alliance* will earn the *Cipher Score* as described in Section 1.5.3.4. The images are as seen by a *Robot* on the *Playing Field*. Note: the *Glyphs* do not have to be perfectly aligned horizontally but all twelve (12) *Glyphs* must be in the proper arrangement to earn the bonus.



Frog



Bird



Snake

Appendix F – Critical Dimensions

Key dimensions for the *Playing Field* and *Game Elements* are shown below. The official Field Setup Guide, which includes additional measurements and *Game Element* placement can be found at <https://www.firstinspires.org/resource-library/ftc/game-and-season-info>.

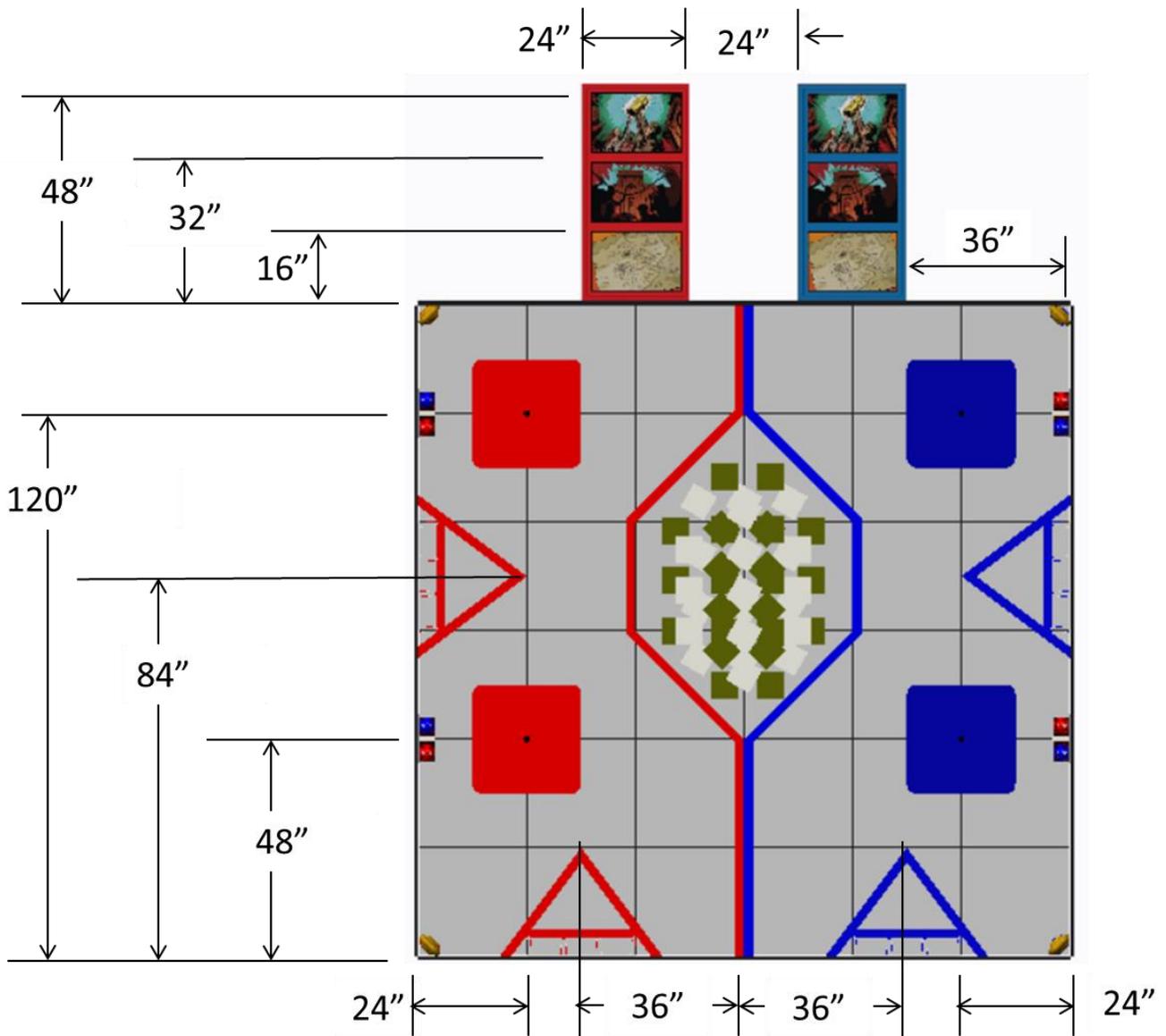


Figure F-1 *Playing Field* Layout

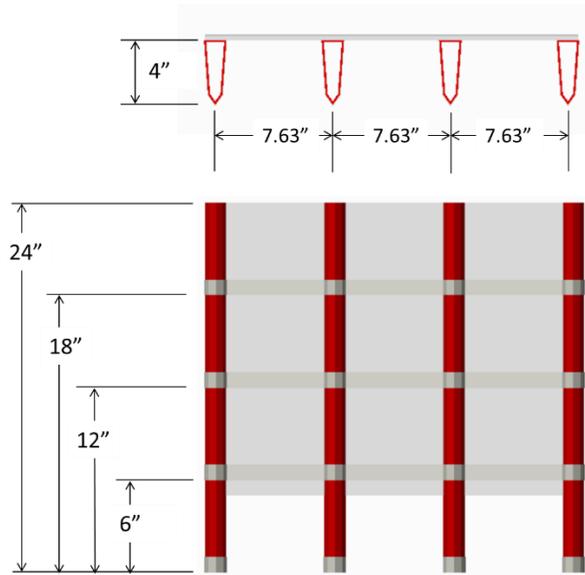


Figure F-2 Cryptobox

Note: The bottom of the 1 inch wide white tape is aligned to the bottom of the Row.

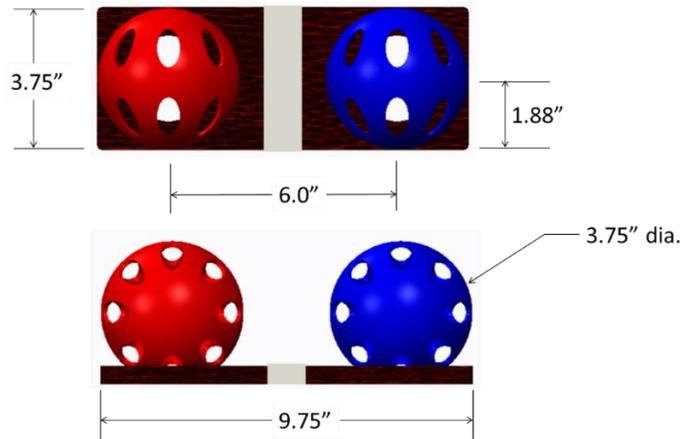
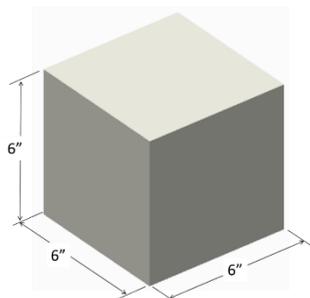


Figure F-3 Jewels and Jewel Platform



The Glyphs are made from a closed-cell foam. Teams should be aware that the actual size of the Glyph will vary as much as +/- 0.25 inches in any direction.

Figure F-4 Glyph

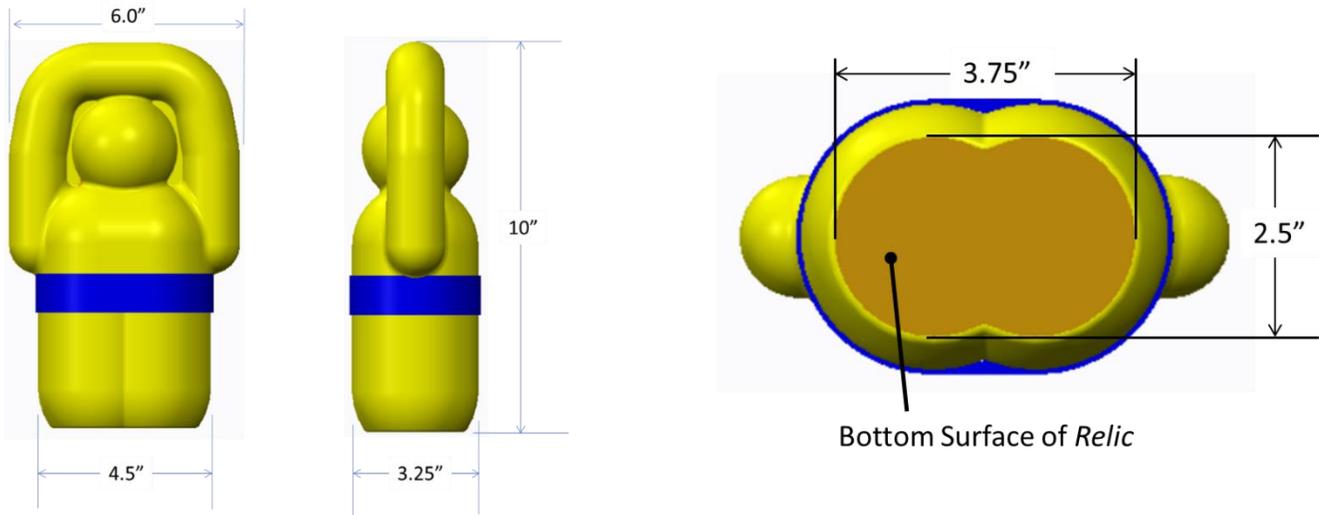


Figure F-5 Relic

A 1-inch wide strip of gaffer tape denotes whether the *Relic* is Red or Blue.

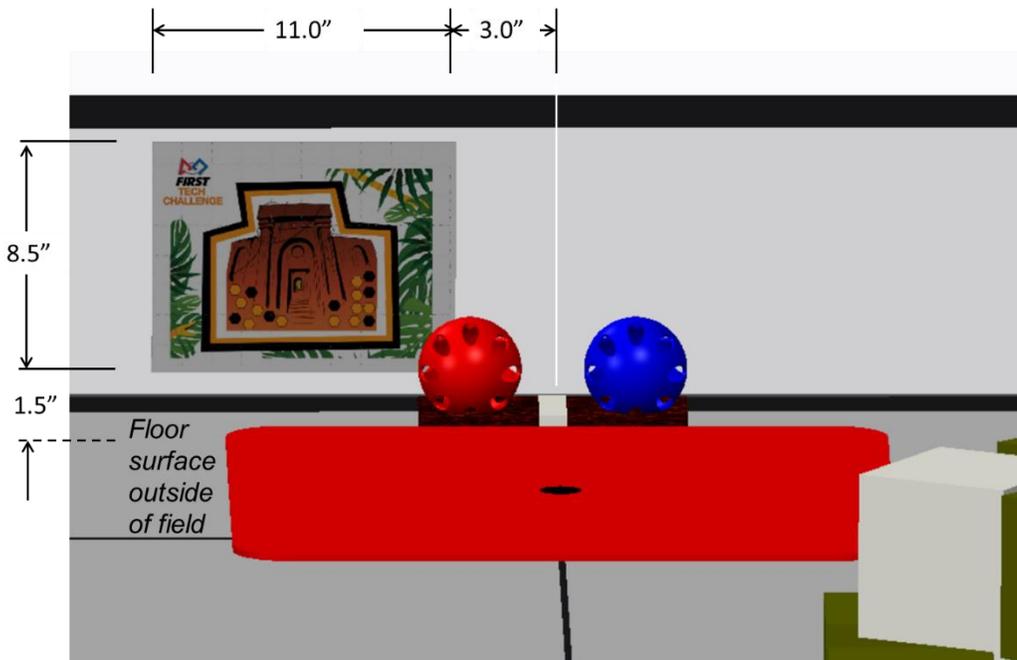
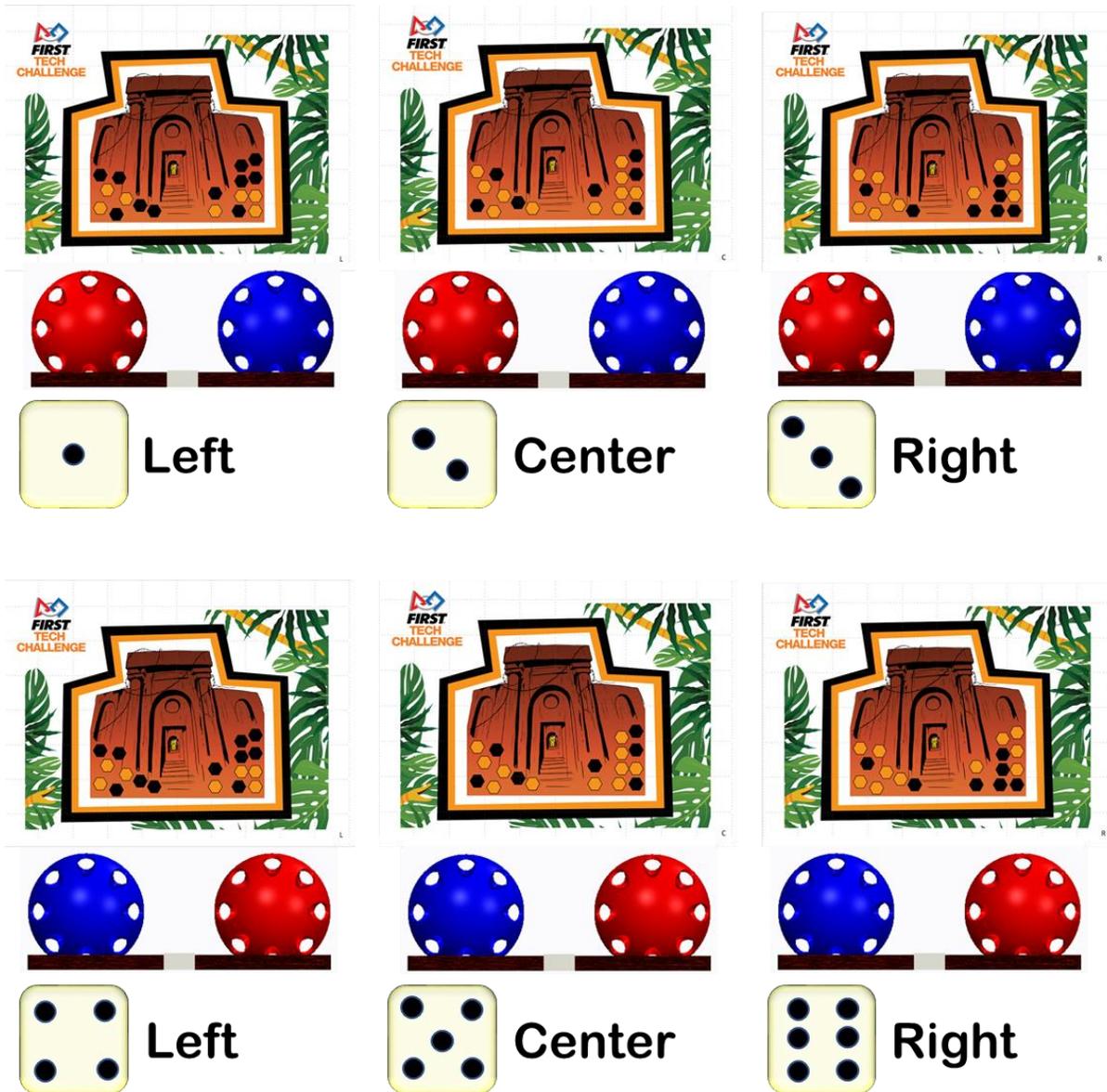


Figure F-6 View of Pictograph and Jewel Set as seen from the Balancing Stone

Regardless of which *Field Perimeter Wall* is used, all *Pictographs* are located on the outside wall of the *Field Perimeter* and are offset 3 inches to the left of the center of the *Balancing Stones* as viewed from a *Robot* sitting on the *Balancing Stone*.

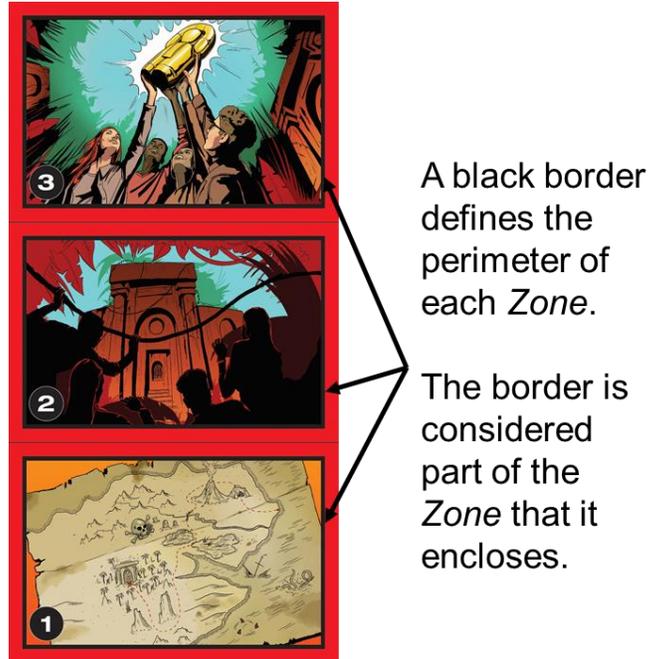
Appendix G – Randomization

The *Pictograph* types (Left, Center, Right) and the orientation of the *Jewels* (*Red Jewel*, left or right) are determined by the roll of a die. The orientation of the *Jewels* is as seen from the viewpoint of someone standing in the middle of *the Playing Field*. The orientation of all four (4) *Jewel Sets* will be the same.

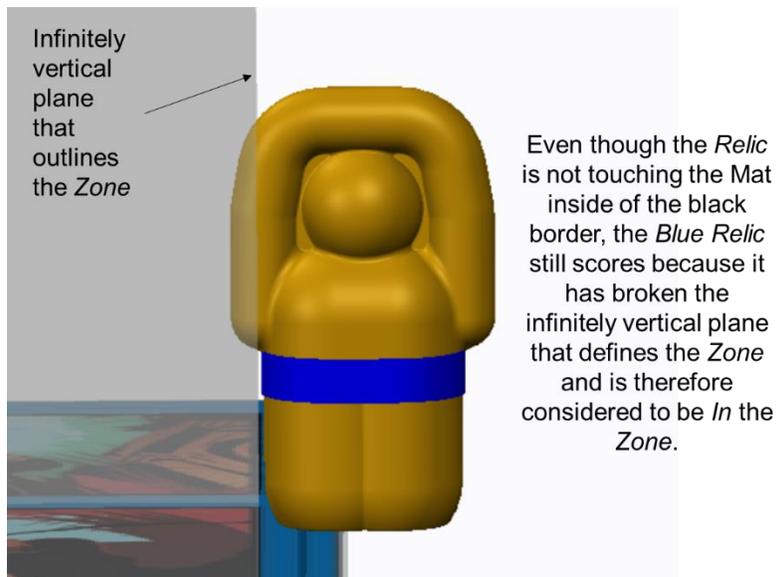


Appendix H – Relic Scoring

Relics are scored when they are *In a Zone*. There are three (3) *Zones* on each *Recovery Zone* mat. They are outlined with a thick, black border.



H-1 *Zone* Borders



H-2 Definition of *In the Zone*

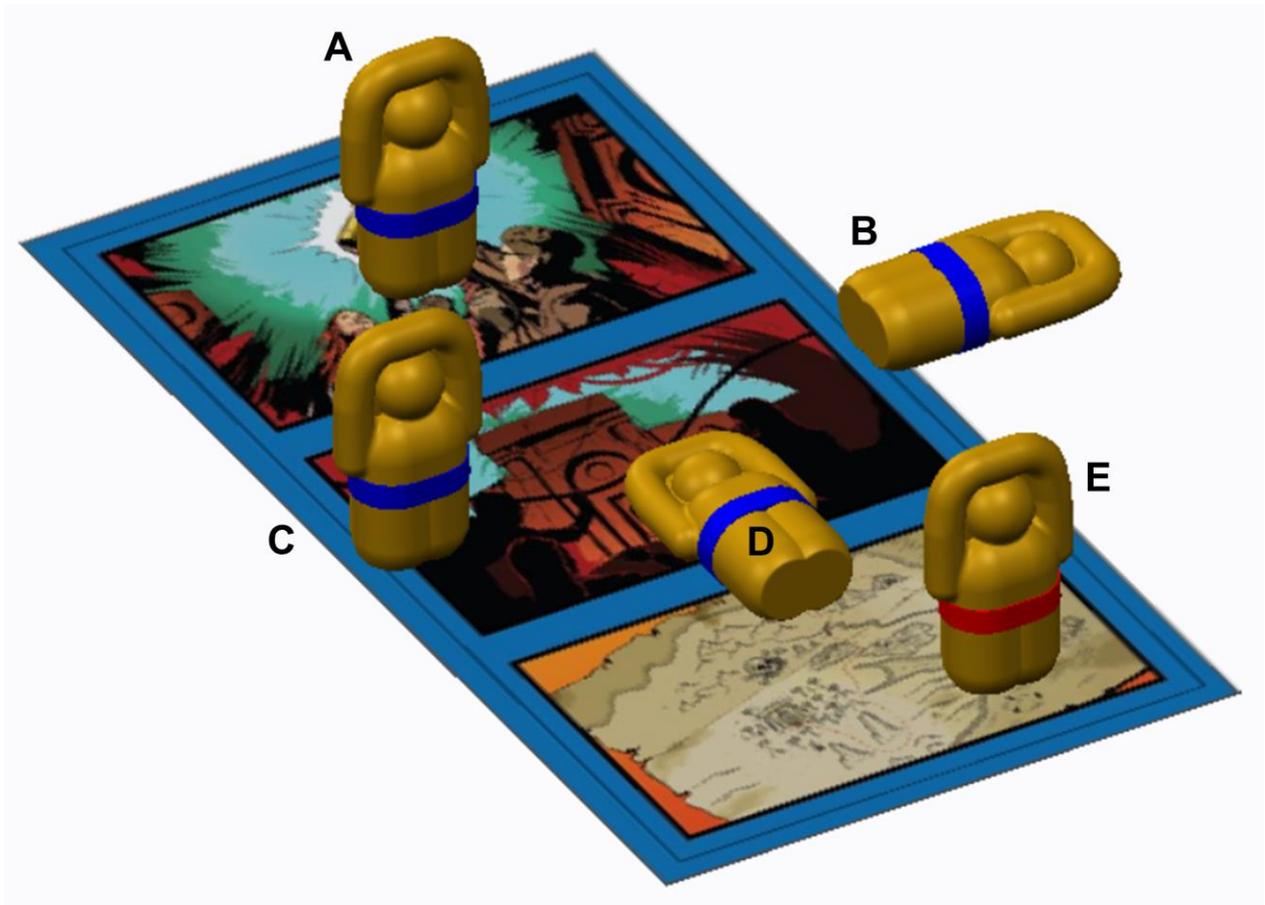


Figure H-3

A – *Blue* earns 40 points for a *Relic* in Zone 3 plus 15 points for the *Relic* being *Upright*

B – *Blue* does not earn any *Relic* points because the *Relic* is not *In* any of the *Zones*

C – *Blue* earns 20 points for a *Relic* in Zone 2 plus 15 points for the *Relic* being *Upright*

D - *Blue* earns 20 points. The *Relic* is *In* both *Zone 1* and *Zone 2* but per Rule 1.5.4.the *Alliance* earns points for the highest value *Zone*.

E – Neither *Blue* nor *Red* earn points for a *Red Relic* in the *Blue Recovery Zone*