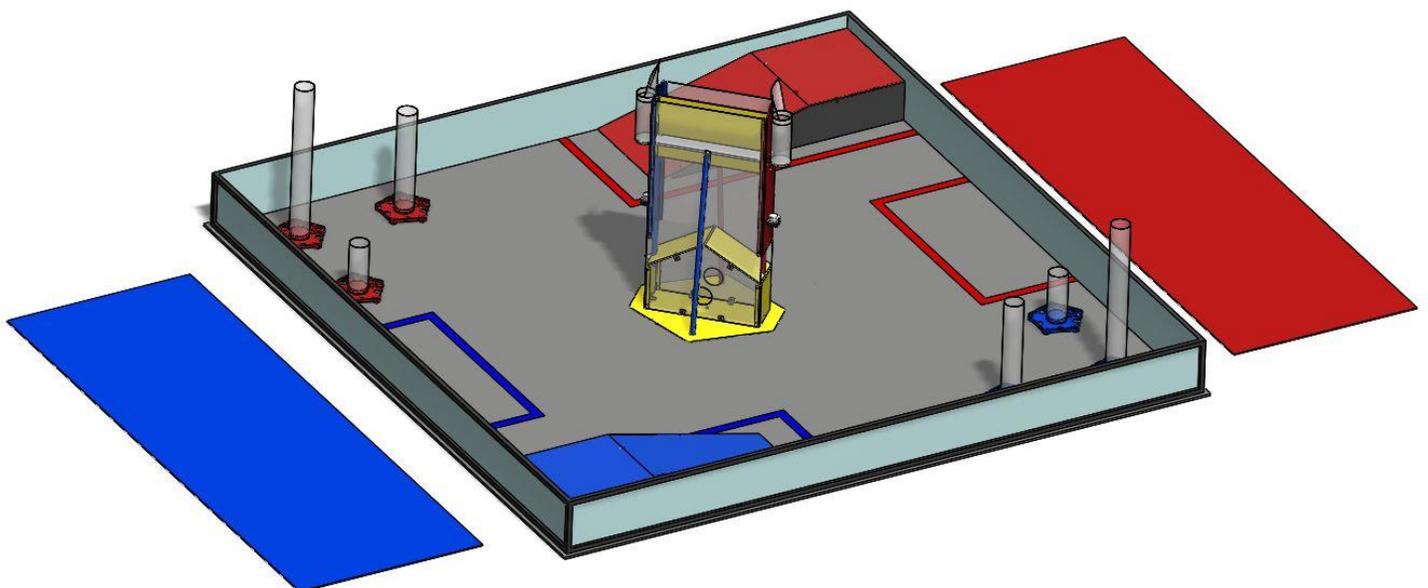




# **FIRST TECH CHALLENGE®**

2014 – 2015 GAME MANUAL PART 2

CASCADE EFFECT<sup>SM</sup> GAME RULES



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TEAMS MUST COMPLY WITH ALL RULES AND REQUIREMENTS STATED IN THIS DOCUMENT AND IN PART 1 OF THE GAME MANUAL. ANY UPDATES TO THE GAME RULES ARE ISSUED ON THE Q&A SECTION OF THE GAME FORUM AT [FTCFORUM.USFIRST.ORG](http://FTCFORUM.USFIRST.ORG). FORUM RULINGS TAKE PRECEDENCE OVER INFORMATION IN THE MANUALS FOR THIS SEASON.

<b>Revision History</b>		
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# 1.0 The Game

## 1.1 Overview

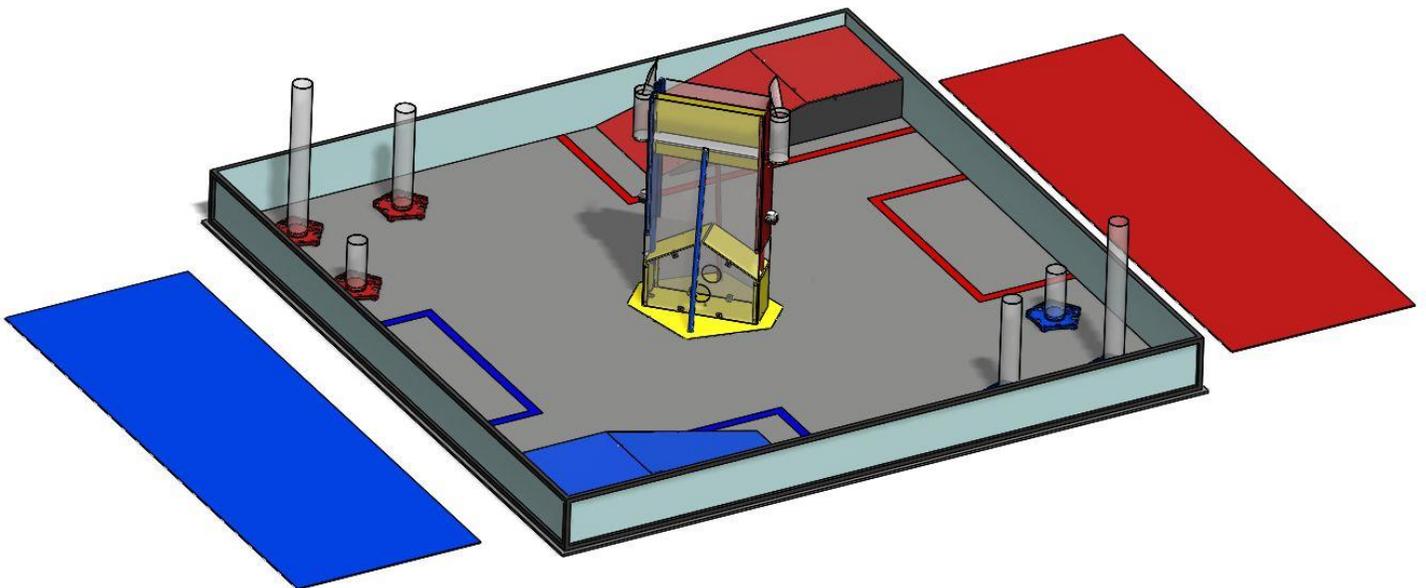
This section describes the *FIRST*<sup>®</sup> Tech Challenge game for the 2014-15 season called CASCADE EFFECT<sup>SM</sup>. It also lists the Game rules and Game definitions. Terms in italics are defined in this Manual specifically for this Game.

## 1.2 Game Description

*Matches* are played on a *Playing Field* initially set up as illustrated in the figure 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 placing plastic *Balls* – both large and small – into various *Goals* on a center structure (*Center Goal*) or into different sized *Rolling Goals*. The Game is played in two distinct periods: Autonomous and Driver-Controlled.

The *Match* starts with a 30-second *Autonomous Period* where *Robots* are operated via pre-programmed instructions only. Prior to the start of the *Autonomous Period*, the *Center Field Structure* will be rotated to one of three positions. Points will be awarded for *Robots* achieving certain tasks including placing Autonomous *Balls* in the *Rolling Goals* and/or *Center Goal*, *Robots* moving off the *Ramp/Platform*, *Releasing the Kickstand* (and releasing balls into the field of play), and moving their *Rolling Goals* into the *Alliance’s Parking Zone*.

The two-minute *Driver-Controlled Period* follows the *Autonomous Period*. *Robots* are tasked with collecting *Balls* and placing them in the *Rolling Goals*. *Balls Scored In* the *Rolling Goals* are worth points based on the length of the *Ball Tube* and the *Ball Height* (Points are scored at the end of the *Match*).



The last thirty (30) seconds of the *Driver-Controlled Period* is called the *End Game*. During the *End Game*, *Robots* may also *Score Balls* into the *Center Goal* as well as the *Rolling Goals*. Teams can also earn bonus points for every *Robot* and *Rolling Goal* that is not in contact with the floor when the *Match* ends and by moving their *Rolling Goals* and/or *Robots* into the *Alliance Parking Zone*.

## 1.3 Game Definitions

The following definitions and terms are used in the Rules sections below.

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

*Alliance Station* – The designated region within which the *Drivers* and *Coach* stand or move during *Matches*.

*Area* – The space defined by the vertical projection of the Outside edge of a region’s boundary (e.g. gaffer’s tape, *Goal*, *Playing Field* perimeter wall, plywood, etc.) The boundary element (tape, wall, markings, etc.) is considered to be part of the *Area* for the purposes of determining *Completely In* or *Inside*.

*Autonomous Period* – A 30-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.

*Ball* – The *Scoring Element* for the game. *Balls* come in two sizes: *Large Balls* (quantity 40) and *Small Balls* (quantity 120). A *Ball* is *Scored* when it is *In* a *Goal’s Ball Tube*.

*Ball Dispenser* – The two locations on the *Center Field Structure* that hold the *Balls* prior to the start of the *Match*. Each *Ball Dispenser* has a *Ball* release mechanism that is held in place by an *Alliance-specific Kickstand*.

*Ball Height* – The measurement from the bottom of the *Ball Tube* to the top of the uppermost *Ball* in the *Ball Tube*, i.e. the height of the stack of *Balls* in the *Ball Tube*. This is used when calculating the *Score* for a *Goal*.

*Ball Tube* – The part of a *Goal* where *Balls* are placed to be *Scored*. It is transparent and each of an *Alliance’s Rolling Goals* has a different length *Ball Tube*.

*Blocking Access* – Preventing a *Robot* from getting to its *Alliance’s Ramp/Platform*, *Parking Zone*, or a *Goal*, e.g. by moving robot(s) and/or rolling goal(s) to obstruct all paths to the item.

*Center Field Structure* – The *Center Field Structure* is composed of the *Ball Dispensers*, *Kickstands*, *Center Goals*, and the plastic base and sides that support those elements.

*Center Goal* – Each *Alliance* has a color-coded *Center Goal*. Its highest point is 120 cm above the *Playing Field Floor*. The *Center Goal* is on the *Center Field Structure* and remains in place.

*Competition Area* – The *Area* where all the *Playing Fields*, *Alliance Stations*, Scoring tables, Queuing tables, and other Event officials and tables are located.

*Control / Controlling* – An object is considered to be *Controlled* by a *Robot* if the object is following the movement of the *Robot*. Examples are: pushing an object still on the *Playing Field* or holding or carrying a *Ball*. *Balls Controlled* by a *Robot* are considered to be part of the *Robot*. Driving through more than the maximum number of *Balls* is acceptable as long as they are not collected, guided, herded, etc.

*Disable* – 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* and to place their Gamepad controllers on the floor in the *Alliance Station*.

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

*Drive Team* – Up to three representatives (two *Drivers* and one *Coach*) from a legally registered entity with *FIRST* and for the Competition.

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

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

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

*End Game* – The last thirty (30) seconds of the *Driver-Controlled Period*.

*Field Control System (FCS)* – The *Field Control System* is the computer hardware and software that will serve as the communications system between the *Drivers* and the *Robot* during a *Match*.

*Field Elements* – The following items are considered to be *Field Elements* for this year’s game: *Ramp/Platform*, *Center Field Structure*, and *Rolling Goals*. See also *Scoring Elements*.

*Goal* – An *Area* where *Robots* place *Balls* to earn points for their *Alliance*.

*In(side) / Completely In(side)* – An object that has crossed the vertical extension of a defined *Area*’s boundary is *Inside* the *Area*. An object that is entirely within the vertical extension of a defined *Area*’s boundary is *Completely Inside* the *Area*.

*Inadvertent* – An action is ruled to be *Inadvertent* when a Referee believes that the action was not a planned strategy.

*Inconsequential* – An action is ruled to be *Inconsequential* when a Referee believes that the action would not have an effect on scoring or gameplay.

*Keep Out Zone* – The *Area* around and including the *Ramp/Platform* delineated by the *Alliance*-specific colored tape.

The *Keep Out Zone* is protected from intrusion by the opposing *Alliance*’s *Robots* or *Rolling Goals* during the *End Game*.

*Kickstand* – The *Alliance*-colored PVC pipe that is used at the start of the *Match* to keep the *Ball* release mechanism closed and prevent the *Balls* from dropping before the start of a *Match*. *Releasing the Kickstand* is defined as deflecting the *Kickstand* sufficiently to disconnect it from the *Ball* release mechanism.

*Match* – A *Match* consists of an *Autonomous Period* followed by a *Driver-Controlled Period* for a total time of two minutes and thirty seconds (2:30).

*Off the Floor* – A *Robot* or *Goal* is said to be *Off the Floor* if it is not physically in contact with the *Playing Field Floor*. A *Robot* or *Goal* may be *Supported* by another *Robot* and/or a *Field Element* or *Scoring Element*.

*On / Completely On* – Physically in contact with and *Supported* by an object, surface, etc. An object that is entirely *Supported* by another object, surface, etc. is defined as *Completely On* the object, surface, etc.

*Parking Zone* – The *Area* of the *Playing Field* taped off in front of each *Alliance Station*. The *Parking Zone* can be used to place *Rolling Goals* or *Robots* for points.

*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 opposing *Alliance* that did not incur the *Penalty*. *Penalties* are further defined into *Minor Penalties* (10 points) and *Major Penalties* (50 points). Some *Penalty* values may be multiplied depending on the level of violation.

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

*Playing Field* – The part of the *Competition Area* that includes the 3.66m x 3.66m (12' x 12') Field and all of the *Field Elements* described in the official Game rules.

*Playing Field Floor* – The part of the *Playing Field* that is covered by tiles. This includes any tape or markings on the tiles.

*Ramp/Platform* – The assembly in the *Area* of the *Playing Field* located in the near corner to the right of each *Alliance Station*. It is where a *Robot* starts the *Match* and *Rolling Goals* and/or *Robots* are placed to *Score* points during the *End Game*. The *Platform* is the 61cm x 61cm (2' x 2') flat portion in the corner. The *Ramp* is the inclined plane leading up to the *Platform*. See *Field Drawings* for details.

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

*Rolling Goal* – There are three color-coded *Rolling Goals* per *Alliance*, each with a different length *Ball Tube*: 30 cm, 60 cm, and 90 cm. The *Rolling Goals* can be moved around the field or to the *Alliance's Ramp/Platform* or *Parking Zone* at any time.

*Scoring* – Teams earn points for their *Alliance* based on the locations of *Robots*, *Balls*, and *Rolling Goals* at the end of the *Autonomous Period* and at the end of a *Match*. Points are *Scored* as defined in the *Game Play* sections below and summarized in the following table:

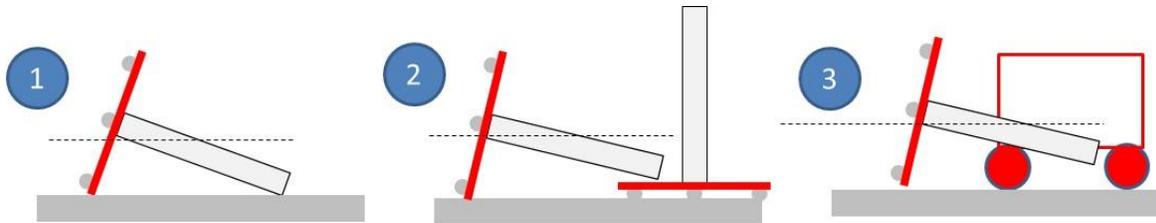
<b>Game Period</b>	<b>Autonomous Period</b>	<b>Driver-Controlled Period</b>	<b>End Game</b>
<i>When Scored</i>	<i>End of Period</i>	<i>Scored at End of Game</i>	
<b>Driving from Platform On to Playing Field floor</b>	20 points		
<b>Releasing the Kickstand to distribute Balls</b>	30 points		
<b>Autonomous Ball In any Rolling Goal</b>	30 points/Goal		
<b>Autonomous Ball In Center Goal</b>	60 points		
<b>Moving Rolling Goal In Parking Zone</b>	20 points/Goal		
<b>Balls Scored In 30 cm (from floor) Rolling Goal</b>		1 point per cm	
<b>Balls Scored In 60 cm (from floor) Rolling Goal</b>		2 points per cm	
<b>Balls Scored In 90 cm (from floor) Rolling Goal</b>		3 points per cm	
<b>Robot / Rolling Goals In Parking Zone</b>			10 points/item
<b>Robot / Rolling Goals Completely Off the Floor</b>			30 points/item
<b>Balls Scored In (from floor) Center Goal</b>			6 points/cm

*Scoring Elements* – The *Balls* and *Rolling Goals* are considered to be the *Scoring Elements* for this year's game.

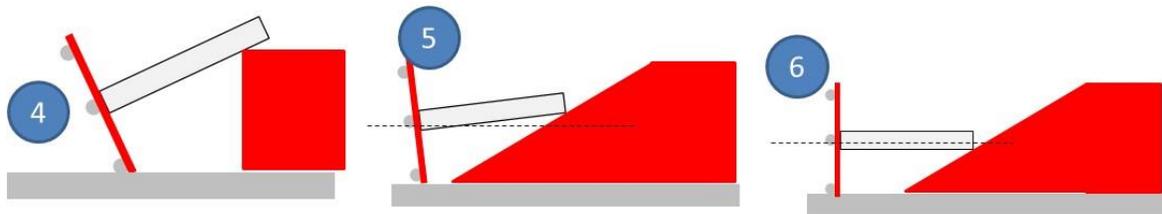
*Support / Supported* – To bear all or part of the weight.

*Team* - Pre-college aged students, mentors, and supporters affiliated with an entity registered with *FIRST* and the competition.

*Tipped Over* – A *Rolling Goal* is said to be *Tipped Over* if the top of its *Ball Tube* is resting on the *Playing Field Floor* or if the underside (wheels) of the *Rolling Goal* is greater than 90° with respect to the *Playing Field Floor*. A situation that is too close to 90° to determine without instruments should be ruled in favor of it NOT being *Tipped Over*. Pictorially:



Examples 1, 2, and 3 are considered to be Tipped Over



Examples 4, 5, and 6 are considered to NOT be Tipped Over.  
#6 is based on benefit of the doubt

*Trap / Trapping* – Preventing an opposing *Alliance Robot* from accessing or escaping from a constrained *Area* of the *Playing Field* for an extended period of time.

## 1.4 Game Play

*Matches* are made up of several periods totaling 2 minutes 30 seconds (2:30). Prior to the start of the *Match*, *Drive Teams* have to perform some basic *Robot* setup steps listed in Section 1.4.1 below. The *Match* starts with a 30-second *Autonomous Period*, followed by a 2-minute *Driver-Controlled Period*. The last thirty (30) seconds of the *Driver-Controlled Period* is called the *End Game*. At the conclusion of the *Match*, the Referees will fill out the *Score* sheets and then signal the *Teams* to collect their *Robots* and leave the *Competition Area*.

### 1.4.1 Pre-Match

*Teams* may place their *Robots* in any orientation on the *Playing Field* with the following constraints:

1. *Robots* start the *Match* Completely On their *Alliance's Platform* or Completely In their *Alliance's Parking Zone* at the discretion of the *Alliance*.
2. The *Alliance's Platform* and *Parking Zone* may contain no more than one *Robot* each.
3. *Robots* may not extend beyond the outer edge of the *Playing Field* perimeter wall.
4. *Robots* starting in the *Parking Zone* must touch the *Playing Field* perimeter wall.

Each Team will receive an *Alliance*-colored *Robot* identification Flag from Field personnel. This Flag must be mounted on the *Robot* as defined in the *Robot* rule <RG08>.

*Rolling Goals* are placed in the corners of the *Field*, per the diagram on Page 1, on the far right in relation to each *Alliance Station*. Each *Rolling Goal* is centered in a tile, with the 90cm *Rolling Goal* in the corner, the 60cm *Rolling Goal* one tile toward the *Alliance's Ramp/Platform*, and the 30cm *Rolling Goal* one tile from the corner toward the opposing *Alliance Parking Zone*.

*Small* and *Large Balls* are distributed approximately evenly into the *Ball Dispensers* and the *Kickstands* are set to keep the *Balls* contained.

Each Team is given two (2) optional *Autonomous Balls* (one large and one small) that, if used, must be placed in contact with their *Robot* during the pre-*Match* setup by any member of the *Drive Team*. The *Autonomous Balls* may touch the *Playing Field* or *Ramp/Platform*, but may only be in contact with a single *Robot*. The *Alliance Flag* and *Autonomous Balls* may extend outside the *Robot* starting volume constraint. A *Robot* can touch a maximum of two *Autonomous Balls* while in the pre-*Match* starting position. *Autonomous Balls* are identical to the *Balls* in the *Ball Dispensers*. Teams are not required to accept/use the *Autonomous Balls*. Unused *Autonomous Balls* will be randomly placed in a *Ball Dispenser* by Field personnel.

After Teams place their *Robots* on the *Playing Field* and pre-load the *Autonomous Balls*, the Referees will rotate the *Center Goal* into 1 of 3 random positions with respect to the *Alliance Station*. A pair of IR beacons are located in the middle of the *Center Goal* pointing outward to help teams find the *Alliance-specific Center Goal*. Once the *Center Goal* is rotated, Teams may not touch or otherwise make adjustments to the *Robots* (per Rule <G18>).

### **1.4.2 Autonomous Period**

The *Match* starts with a 30-second *Autonomous Period* where *Robots* are operated via pre-programmed instructions only, performing various tasks to earn points.

When the *Autonomous Period* ends, points are awarded as follows:

- 20 points for a *Robot* that started the *Match Completely On* the *Platform* and got *On* to any portion of the *Playing Field Floor*.
- 20 points for each *Rolling Goal* In its *Alliance's Parking Zone*.
- 30 points for *Releasing the Kickstand* (whether or not the *Balls* scatter onto the *Playing Field*).
- 30 points for each *Rolling Goal* In which at least one *Autonomous Ball* is *Scored*. (Note that this *Score* is per *Goal*, not per *Ball*.)
- 60 points if any *Autonomous Balls* are *Scored In* the *Center Goal*.

Note that the *Scores* for the *Kickstand* and *Goals* are based solely on the object's color, regardless of which *Alliance* accomplished the action.

### **1.4.3 Driver-Controlled Period**

At the conclusion of the *Autonomous Period*, *Drivers* pick up their Gamepad controllers and a two-minute *Driver-Controlled Period* begins. *Robots* are tasked with collecting *Balls* and placing them *In* the *Rolling Goals*. *Balls* are legally able to be *Scored* once they have made contact with the *Playing Field Floor*. *Autonomous Balls* that were not *Scored* during the *Autonomous Period* may be *Scored* as regular *Balls* during the *Driver-Controlled Period*. *Balls*

Scored In the Rolling Goals are worth points based on the length of the *Ball Tube* and the *Ball Height* (at the end of the *Match*), as shown in the table below. The table also shows the maximum point value for each *Rolling Goal*.

<b>Rolling Goal Height from floor</b>	<b>Points per cm of Ball Height</b>	<b>Maximum Points</b>
30 cm	1 point per cm	27
60 cm	2 points per cm	114
90 cm	3 points per cm	261

#### **1.4.4 End Game**

The last thirty (30) seconds of the *Driver-Controlled Period* is called the *End Game*. During the *End Game*, *Robots* may *Score Balls* into the *Center Goal*. *Rolling Goals* and *Robots* can also park *Completely Off the Playing Field Floor* or *In the Parking Zone*. *Robots* may continue to *Score Balls In the Rolling Goals*.

When the *Match* ends, points are awarded as follows:

- 10 points for each *Robot In its Alliance's Parking Zone*.
- 10 points for each *Rolling Goal In its Alliance's Parking Zone*.
- 30 points for each *Robot Completely Off the Playing Field Floor*.
- 30 points for each *Rolling Goal Completely Off the Playing Field Floor*.
- 6 points for each cm of *Ball Height* for *Balls Scored In the Center Goal*.

Note: the *Rolling Goal* can only achieve one *Scoring* milestone (for example, *Off the Floor* and *In the Parking Zone*). It will be *Scored* for the highest value achieved.

#### **1.4.5 Post Match**

After the *Match* is over, the Referees will determine where *Robots* and *Rolling Goals* are located and the *Ball Height* for each *Goal*. After they are finished, the Head Referee will signal for the *Drive Teams* to enter the *Playing Field* and retrieve their *Robots*. The *Drive Teams* should return any *Unscored Balls* that are *Possessed* by the *Robot* to the Field and return the *Alliance-colored Robot* identification Flag to the Field Reset Crew. The Field Reset Crew will set up the *Playing Field* for the next *Match* at that time.

#### **1.4.6 Penalty Scoring**

*Penalty* points are added to the non-offending *Alliance's Score* at the end of the *Match*. *Minor Penalties* give the opposing (non-offending) *Alliance* 10 points per occurrence. *Major Penalties* give the opposing (non-offending) *Alliance* 50 points per occurrence.

### **1.5 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 Part I of the Game Manual). Violation of these rules may lead to *Penalties* and/or *Disqualification* of the offending Team and/or *Alliance*.

### 1.5.1 Safety Rules

<S1> If at any time the *Robot* operation is deemed unsafe or has damaged the *Playing Field*, another *Robot*, *Field Elements*, surface, or perimeter walls, by the determination of the Referees, the offending *Robot* will be *Disabled* and the *Team* may be *Disqualified*. The *Robot* will require re-Inspection before it may compete again.

Note: Teams should pay close attention to other *Robot*-specific Safety rules outlined elsewhere in other sections of the Game Manual.

<S2> If any portion of the *Robot* goes Outside of the perimeter wall and makes contact with anything Outside of the *Playing Field* it will be *Disabled* for the remainder of the *Match*. Repeated offenses of this rule may lead to *Disqualification*.

<S3> If any member of the *Drive Team* is found not to be wearing Safety Glasses and/or Closed-toe Shoes, the Referee will issue a warning and if the situation isn't remedied within 30 seconds, the offending member 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 <G19>.

### 1.5.2 General Game Rules

<G1> Before the start of a *Match*, each *Robot* must not exceed a volume of 45.7cm (18") wide by 45.7cm (18") long by 45.7cm (18") tall. An offending *Robot* will be *Disabled*/turned off for the *Match* at the Head Referee's discretion and must remain on the *Playing Field* without any power for the length of the *Match*. Alignment devices are allowed only if they are constructed from legal components and they remain within the starting volume constraint of the *Robot* and remain attached to the *Robot* for the duration of the *Match*.

<G2> Each *Drive Team* shall include up to two *Drivers* and one *Coach*. Electronic communications (cell phone, two-way radio, Wi-Fi, etc.) by *Drive Team* members after an *Alliance* has been called 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 resulting in a *Minor Penalty* and/or *Disqualification*. Items that may be mistaken by a casual observer as being in violation should not be brought to the *Playing Field* violate this rule.

<G3> During a *Match*, the *Drivers* and *Coach* must remain *In* 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* and/or *Disqualification*. Leaving the *Alliance Station* for safety reasons will not result in a warning or *Penalty*.

<G4> During a *Match*, the *Drivers* and *Coaches* are prohibited from making contact with the *Playing Field* or any Game or Field object. The first instance of contact will result in a warning, with any following instances resulting in a *Minor Penalty* and/or *Disqualification*. Contact that affects *Scoring* and/or Game play will result in *Disqualification*.

<G5> During a *Match*, *Robots* must be remotely operated only by the *Drivers* using the Gamepads supplied by the Tournament Director and/or by Software running in the on-board Control System. The first instance of *Coach Interference* (e.g. touching a Gamepad) will result in a warning, with any following instances resulting in a *Major Penalty* and/or *Disqualification*.

<G6> Scores will be recorded at the end of the *Autonomous Period* and *Driver-Controlled Period* when all objects on the *Playing Field* have come to rest.

- <G7> *Robots* may not deliberately detach parts during any *Match* or leave mechanisms on the *Playing Field*. If a deliberately detached component or mechanism affects *Scoring*, a *Major Penalty* will be assessed, the *Robot* will be *Disabled*, and the *Team* will be *Disqualified*. Multiple infractions may result in *Disqualification* for the entire *Competition*.
- <G8> *Robots* may not grab, grasp, grapple, damage, or attach to any *Playing Field* Element or structure other than *Scoring Elements*, unless specifically allowed by Game-specific rule(s) listed in Section 1.5.3. Violations of this rule may result in a *Major Penalty* and/or *Disqualification*.
- <G9> Strategies and mechanisms aimed solely at the destruction, damage, tipping over, or entanglement of *Robots* and *Field Elements* are not in the spirit of the *FIRST* Tech Challenge and are not allowed. However, FTC Games are highly interactive and *Robot-to-Robot* contact and defensive Game play should be expected. Some robot 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 may be *Disabled* and/or *Disqualified* for that *Match*. Repeated offenses could result in a *Team* being *Disqualified* from the remainder of the competition. See also <G19>.
- <G10> A *Robot* cannot *Pin* or *Trap* another *Robot* 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 and the offending *Robot* may be *Disabled* for the *Match*. In general, *Pinning* or *Trapping* will not be called during *Autonomous* mode. However, *Autonomous* strategies that appear to be intended to *Pin* or *Trap* an opposing *Alliance's Robot* may result in a *Minor Penalty*, or if chronic, *Disqualification*. If a *Pinning* or *Trapping* occurrence happens during the *Autonomous Period*, the first action done by the offending *Robot* during the *Driver-Controlled Period* must be to back away from the *Pinned* or *Trapped Robot* or a *Minor Penalty* will be assessed. If a Referee declares a *Pinning* or *Trapping* warning during the *Match*, the offending *Robot* must back away at least 0.9m (3 feet) or the approximate distance of 1.5 floor tiles from the *Pinned* or *Trapped Robot*.
- <G11> 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 rule violations committed by the affected *Alliance* shall be excused, and *Penalties* will not be assessed. Strategies that appear to force an opposing *Alliance's Robot* to violate the rules are a violation of *Gracious Professionalism* and, if chronic, may result in the application of <G19>.
- <G12> *Robots* must be designed to permit easy removal of *Scoring Elements* and *Field Elements* from any grasping, containing, or holding mechanism after the *Match* without need of the *Field Control System*. *Robots* should also be able to be removed from the *Field* without need of the *Field Control System* or damaging the *Playing Field*. If this rule is violated, a *Minor Penalty* will be assessed and re-Inspection may be required before the *Team* is allowed to compete again. Repeated offenses may lead to *Team Disqualification*.
- <G13> At the beginning of a *Match*, each *Alliance Robot* must be set up on the *Playing Field* in accordance with section 1.4.1 *Pre-Match*. *Drive Teams* are required to stand *Completely In* the *Alliance Station* at the location (station one or station two) specified by the *Match* schedule to ensure that the Gamepads are assigned to the correct *Drive Team* and *Robot*.
- During the qualification *Matches*, the *Blue Alliance Robots* will set up on the *Playing Field* first unless *Red* waives their right to set up on the *Playing Field* second.

- b. During the elimination *Matches*, the lower seeded (e.g. 3rd seed is lower than 2nd seed) *Alliance Robots* will set up on the *Playing Field* first unless the higher seeded *Alliance* waives their right to set up on the *Playing Field* second.
- c. Teams that deliberately delay the start of the *Match* are not considered Gracious or Professional and will incur a *Minor Penalty* for each offense. Repeated offenses may lead to *Disqualification*.

<G14> *Matches* are replayed at the discretion of the Head Referee and only under the following circumstances:

- a. Failure of a *Field Element* that was likely to have impacted which *Alliance* won the *Match*.
- b. Loss of control of a *Robot* due to a VERIFIABLE failure of the tournament-supplied FCS computer, FCS software, USB Hub, or Gamepad that was likely to have impacted which *Alliance* won the *Match*.
- c. Loss of control of all four *Robots* due to a failure of the Field's wireless router 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 failures, *Robot* communication failures, etc. are **NOT** valid justifications for a re-*Match*.

<G15> At the conclusion of the *Autonomous Period*, the Referees will, if needed, untangle *Robots*, place *Robots* on their drivetrains, make minor adjustments to *Robot* position, etc. so that the *Robots* can participate in the Driver-Controlled portion of the *Match*. The Referees will do this after finding out from the Team where the best place is to touch their *Robot*. Power to the *Robot* may also be reset under supervision of the Field Technical Advisor as long as the *Match* is not extraordinarily delayed. If the *Robot* cannot be controlled after attempts to get it working with the field, it will be *Disabled* for the remainder of the *Match*.

<G16> Field and *Field Element* tolerances may vary by as much as +/-2.5cm (1.0"). Teams must design their *Robots* accordingly.

<G17> *Robots* may not deliberately remove *Scoring or Field Elements* from the *Playing Field*. Field personnel will replace *Scoring or Field Elements* that incidentally fall Outside the *Playing Field* at the earliest convenient opportunity. Teams deliberately removing *Scoring or Field Elements* from the *Playing Field* will incur a *Minor Penalty* per occurrence. Continued violation of this rule may lead to *Disqualification*.

<G18> Teams are not allowed to touch their *Robots* once the Referee has moved all items into a *Match* starting location. If this occurs, a *Minor Penalty* will be assessed to the violating *Alliance* and the affected Team's *Robot* is not eligible to *Score* in the *Autonomous Period*.

<G19> Egregious *Robot* or Team member behavior at the *Playing Field*, as determined by the Referees, will result in a *Major Penalty* and possible *Disqualification*. Subsequent violations will result in Team *Disqualification*. Egregious behavior includes, but is not limited to, repeated and/or flagrant violation of Game rules, uncivil behavior towards *Drivers, Coaches*, competition personnel, or Event attendees, and repeated or flagrant unsafe behavior or actions.

### 1.5.3 Game-Specific Rules

<GS1> *Robots* may not *Control* more than five (5) *Balls* at any time. If a *Robot* is *Controlling* more than five (5) *Balls*, the *Alliance* will incur an immediate *Minor Penalty* for each *Ball* above the limit plus an additional *Minor Penalty* per

extra *Ball* for each 5-second interval that this situation continues. A *Double Minor Penalty* will be assessed for each *Ball Scored* while a *Robot Controls* more than five (5) *Balls*.

- <GS2> *Balls* must have been collected off of the *Playing Field Floor* to be eligible to be *Scored*. *Balls* that deliberately fall into *Possession* of a *Robot* without having been on the *Playing Field Floor* must be relinquished and then recollected before they can be *Scored*. Teams that violate this rule will be assessed a *Double Minor Penalty*.
- <GS3> *Balls* that are in contact with a *Robot* on the corresponding *Alliance* for the *Goal* at the end of the *Match* have zero *Score* value.
- <GS4> *Robots* may *Score Balls* into any of the opposing *Alliance's Goals* as long as no other rules are violated.
- <GS5> *Robots* may not *de-Score Balls* from any of the opponent *Alliance's Goals*. If *Balls* are *de-Scored*, the offending *Alliance* will incur a *Major Penalty* per incident plus a *Penalty* equal to the maximum *Ball Tube* points for that *Goal*. Please note that <GS14> may also apply.
- <GS6> During the *Autonomous Period*, *Robots* can only *Score* pre-loaded *Balls*. If any *Balls* other than the four *Autonomous Balls* are *Scored* by an *Alliance* during the *Autonomous Period*, their *Autonomous Period Ball Score* is zero. They can, however, still get a *Ramp/Platform* or *Kickstand Bonus*.
- <GS7> *Robots* may not begin *Scoring Balls* into the *Center Goal* during the *Driver-Controlled Period* before the *End Game* begins. If this occurs, the offending *Alliance* will not *Score* any *Center Goal End Game* points.
- <GS8> *Robots* may grab onto their own *Alliance's Rolling Goal* in any location except for the *Ball Tube*. Incidental contact with the *Ball Tube* during *Scoring* or pushing is allowed. *Robots* that grab their *Rolling Goals* by the *Ball Tube* will incur a *Minor Penalty* immediately and will incur additional *Minor Penalties* per five (5) second interval that this situation continues.
- <GS9> *Robots* may not grab, grasp, grapple, nor attach to the opposing *Alliance's Rolling Goals* at any time. *Robots* that violate this rule will be assessed a *Minor Penalty* unless the violation is continuous and/or repeated. If Teams perform continuous or repeated occurrences of this violation, they will be assessed a *Major Penalty* and may be *Disqualified* for the *Match*.
- <GS10> *Robots* may push any *Rolling Goals* (belonging to their *Alliance* or the opposing *Alliance*) as long as no other rules are violated.
- <GS11> *Robots* may not move the opposing *Alliance's Rolling Goal* FROM the opposing *Alliance's Parking Zone*. If this occurs, the offending *Alliance* will incur a *Major Penalty*.
- <GS12> *Robots* may not push any *Alliance's Rolling Goal In* to the opposing *Alliance's Parking Zone* or *Keep Out Zone*. *Robots* that violate this rule will be assessed a *Major Penalty* unless the violation is continuous and/or repeated. If Teams perform continuous or repeated occurrences of this violation, they may be *Disqualified* for the *Match*.
- <GS13> *Robots* may not push the opposing *Alliance's Rolling Goal* during the *End Game*. Contact that is determined by the Referees to be *inadvertent* and *Inconsequential* will not result in a *Penalty*. *Robots* that violate this rule will be assessed a *Minor Penalty* unless the violation is continuous and/or repeated. If Teams perform continuous or repeated occurrences of this violation, they will be assessed a *Major Penalty* and may be *Disqualified* for the *Match*.

<GS14> Robots may not tip over ANY Rolling Goal (deliberately or accidentally). If this occurs, the offending Alliance will incur a Major Penalty.

<GS15> Robots may not score Balls into a Rolling Goal that is Tipped Over. If this occurs a Minor Penalty will be assessed per Ball.

<GS16> During the End Game, an Alliance may not intrude In to the opposing Alliance's Keep Out Zone or otherwise Block Access to the opposing Alliance's Ramp/Platform. If this occurs, the offending Alliance will incur a Major Penalty. Intrusion In to the opposing Alliance's Keep Out Zone that is determined by the Referees to be Inadvertent and Inconsequential will not result in a Penalty.

<GS17> An Alliance may not Block Access to the opposing Alliance's Rolling Goals at any time. If this occurs, the offending Alliance will incur a Major Penalty.

<GS18> During the End Game, an Alliance may not Block Access to the opposing Alliance's Center Goal. If this occurs, the offending Alliance will incur a Major Penalty.

<GS19> During the End Game, an Alliance may not Block Access to the opposing Alliance's Parking Zone. If this occurs, the offending Alliance will incur a Major Penalty.

## 1.6 Penalty Summary

There are two types of Penalties in CASCADE EFFECT<sup>SM</sup> – Minor (10 points) and Major (50 points). The following table shows a summary of the possible rule violations and their consequences. Please refer to the rule above for complete details.

Rule	Violation	Penalty Type				
		Warning	Minor	Major	Disable	Disqualify
<b>GENERAL GAME RULES</b>						
<S1>	Unsafe Robot				X	DQ
<S2>	Robot goes outside of the Perimeter walls				X	DQ
<S3>	Drive Team not wearing Safety materials	w				
<G1>	Robot too big before start of match				X	
<G2>	Use of electronic communications after being called for a Match.	w	1x			DQ
<G3>	Drive Team Outside of Alliance Station.	w	1x			DQ
<G4>	Drive Team contacts Field or Game object.	w	1x			DQ
<G5>	Coach touches Gamepad controller after start of Match.	w		1x		DQ
<G7>	Robot deliberately detaches parts on Playing Field that prevent additional Scoring.			1x	X	DQ
<G8>	Robot attaches to Playing Field Element other than the excepted items.			1x		DQ
<G9>	Deliberate tipping, entanglement, or damage.			1x	X	DQ
<G10>	Pinning or Trapping.		1x			DQ
<G12>	Game Elements must be easily removed after Match		1x			DQ
<G13>	Team delays start of Match.		1x			DQ
<G17>	Deliberately removing Game Elements from the Playing Field.		1x			DQ
<G18>	Team touches Robots or Gamepads after Referee sets field ready to start Match		1x			
<G19>	Egregious Robot or Team member behavior.			1x		DQ
<b>CASCADE EFFECT™ SPECIFIC GAME RULES</b>						
<GS1>	Robots Possessing more than 5 Balls.		1x			
<GS2>	Balls not collected from Playing Field Floor before being Scored		2x			
<GS5>	Descoring Balls from the Center or Rolling Goals			1x +		
<GS6>	More than 2 Balls Scored during Autonomous Period.					
<GS7>	Scoring Balls in Center Goal during Driver Controlled period (not End Game)			V		
<GS8>	Grabbing onto their own Rolling Goal around the clear Ball Tube		1x			
<GS9>	Grabbing opposing Alliance's Rolling Goal		1x	1x		DQ
<GS11>	Moving opponents rolling goal from parking zone			1x		
<GS12>	Push Rolling Goals into opposing Alliances Parking Zone			1x		DQ
<GS13>	Push the opposing Alliance's Rolling Goal during End Game		1x	1x		DQ
<GS14>	Tip over any Rolling Goal			1x		
<GS15>	Scoring Balls in a Tipped Over Rolling Goal (penalty per Ball)		1x			
<GS16>	Blocking access to opposing Alliance's Ramp/Platform during End Game			1x		
<GS17>	Blocking access to opposing Alliance's Rolling Goal at any time			1x		
<GS18>	Blocking access to opposing Alliance's Center Goal during End Game			1x		
<GS19>	Blocking access to opposing Alliance's Parking Zone during End Game			1x		
<b>Column Key</b>						
w: warning			DQ: team disqualified from match			
1x: penalty at normal (single) cost			V: varies			
2x: penalty at double cost			X: robot disabled; team may be disqualified			