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1. THE GAME

1.1 INTRODUCTION

The Game section of the 2000 FIRST Robotics Competition Manual provides a comprehensive description of the game, playing field layout and construction, match scoring, and competition rules.

1.2 GAME DESCRIPTION

Section 1.2 provides an overview of the 2000 FIRST Robotics Competition Game. *See Appendix A for the complete list of rules.*

1.2.1 COMPETITION STRUCTURE

The competition is composed of two phases: Qualification Matches and Elimination Matches. Teams will be paired together to form alliances. An alliance will work together to try to win a match. Alliances will win or loose as a single unit, and any points and/or victories will apply equally to both teams within an alliance. *See rule GM3.*

PHASE I: QUALIFICATION MATCHES

During qualification matches, alliances will be formed just prior to the start of each match, and will last only for the duration of that match. Thus, teams that will be allies in one match may be opponents in another upcoming match. All teams will play an equal number of qualification matches.

Following the conclusion of qualification matches, the cumulative results of each team's qualification matches will be used to rank the teams. The eight highest ranked teams at each Regional event, sixteen teams at the National Championship, qualify to move on to the elimination matches.

PHASE II: ELIMINATION MATCHES

Prior to the start of elimination matches, each of the top eight qualifying teams at any one of the Regional Events and top sixteen at the National Championship, will select an ally from the remaining teams. **If one of the top seeds selects another seeded team as an alliance partner, the team with the next highest qualifying points becomes seeded until all alliances have been formed.** Once these alliances have been formed, each of them will again pick from the remaining teams, a third to serve as their alternate alliance partner. The alliances formed at this stage will stay together for the remainder of the elimination matches, which will be a best 2-of-3 series to determine the winning alliance.

1.2.2 BASIC GAMEPLAY

During a match, each alliance scores points by placing balls in their goal, and by positioning their robots in designated areas at the end of each match. Each alliance will compete using two (2) team-built robots, four (4) robot operators, two (2) human players, and four (4) coaches. The "Ball" is a textured rubber playground ball that is approximately 13-inches in diameter. **Balls will be inflated to size not pressure.** There are two 6-foot high, fixed goal structures located mid-field. Each alliance has its own color coded goal. Under each goal is a 30-inch high clearance bar, which robots may pass under to access the opposite end of the field.

Connecting the two goals in the center of the field is an 8-foot wide carpeted ramp, which the robots may also use to access the opposite end of the field. This section has a 5-foot high clearance bar that robots may hang from to acquire points.

At the end of a match, robot position on the ramp may also generate additional points. Information on construction of the playing field and ramp are included in the field parts list documentation which is supplied with the manual at the Kick-Off Workshop.

The robots will compete within the bounds of the playing field, while the human players will be located at stations just outside the playing field. Only human players and robots may score points with the balls. *See Section 1.2.3 for information on playing field layout.*

Each match will last two minutes. In order to win a match, an alliance must score more points than the other alliance. *See section 1.2.4 for information on scoring.*

1.2.3 PLAYING FIELD LAYOUT

At the start of each match, each alliance station will contain seven (7) yellow balls and one (1) black ball. Fifteen (15) yellow balls and two (2) black balls will be located at the far end of the playing field. All balls may be used to score points by either alliance.

The placement of alliance stations, goals, ramp and robots as well as the starting locations of all balls are shown in Figure 1.1. **Please note that Figure 1.1 may not be drawn to scale and is not intended for use during playing field construction. For playing field dimensions, please refer to the field parts list documentation which is supplied with the manual at the Kick-Off Workshop.**

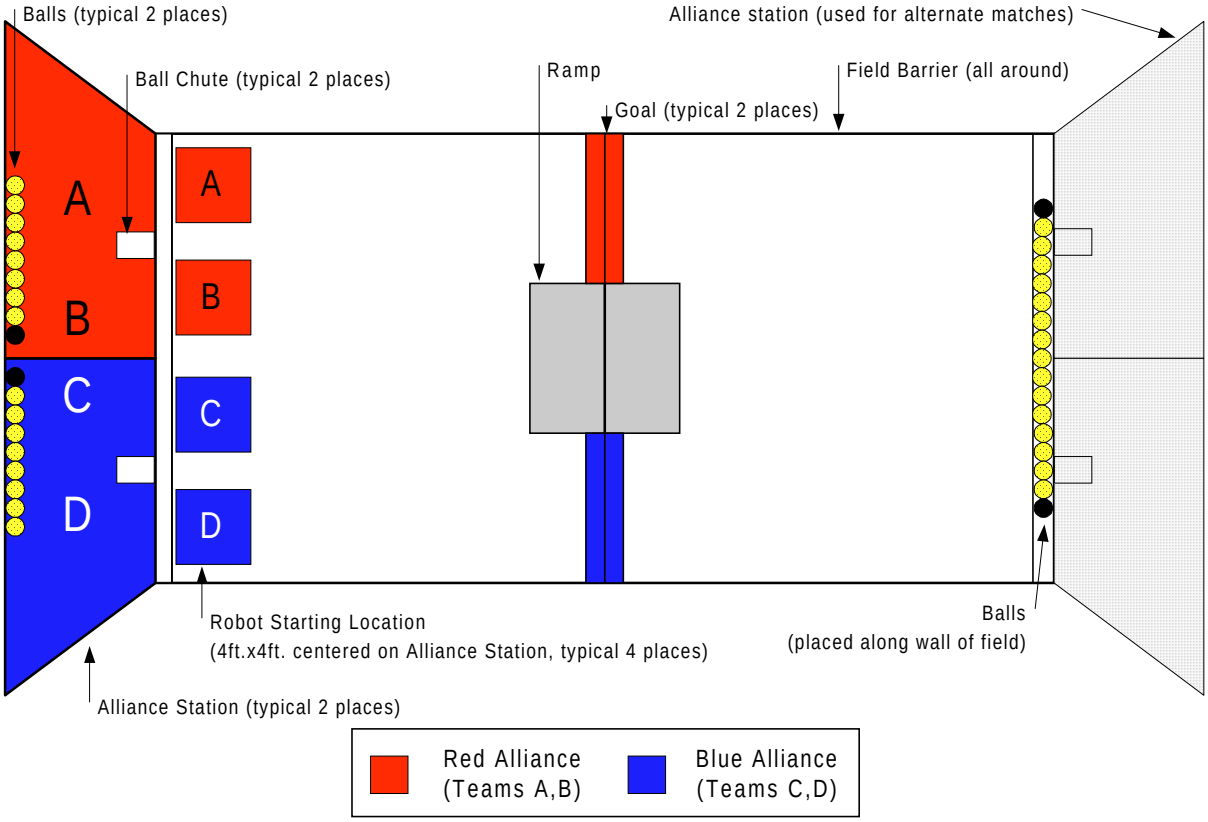

Figure 1.1: Playing Field Layout

1.2.4 MATCH SCORING

At the end of each two-minute match, points will be awarded to alliances based on the criteria outlined below.

The complete list of scoring and tie breaking criteria is contained in Appendix A. Each alliance will receive one (1) point for each yellow ball, and five (5) points for each black ball in the goal, and not in contact with or supported by your robot.

All balls in scoring position cannot be in contact with or supported by your robot. If another alliance robot is in contact with your ball, it will not count against you. Each alliance will receive five (5) points for each of its robots that are completely "on" the ramp. Each alliance will receive ten (10) points for each robot "hanging" from the horizontal bar connecting the two goals. A robot being held by its alliance partner off the carpeted playing field surface is worth an additional 10 points. *See rule DQ12.* Figure 1.3 illustrates a robot hanging.

Figure 1.2 below illustrates balls in a scoring position within the goal structure. The alliance with the most points wins the match. See Appendix A for the complete list of game rules including tie breakers.

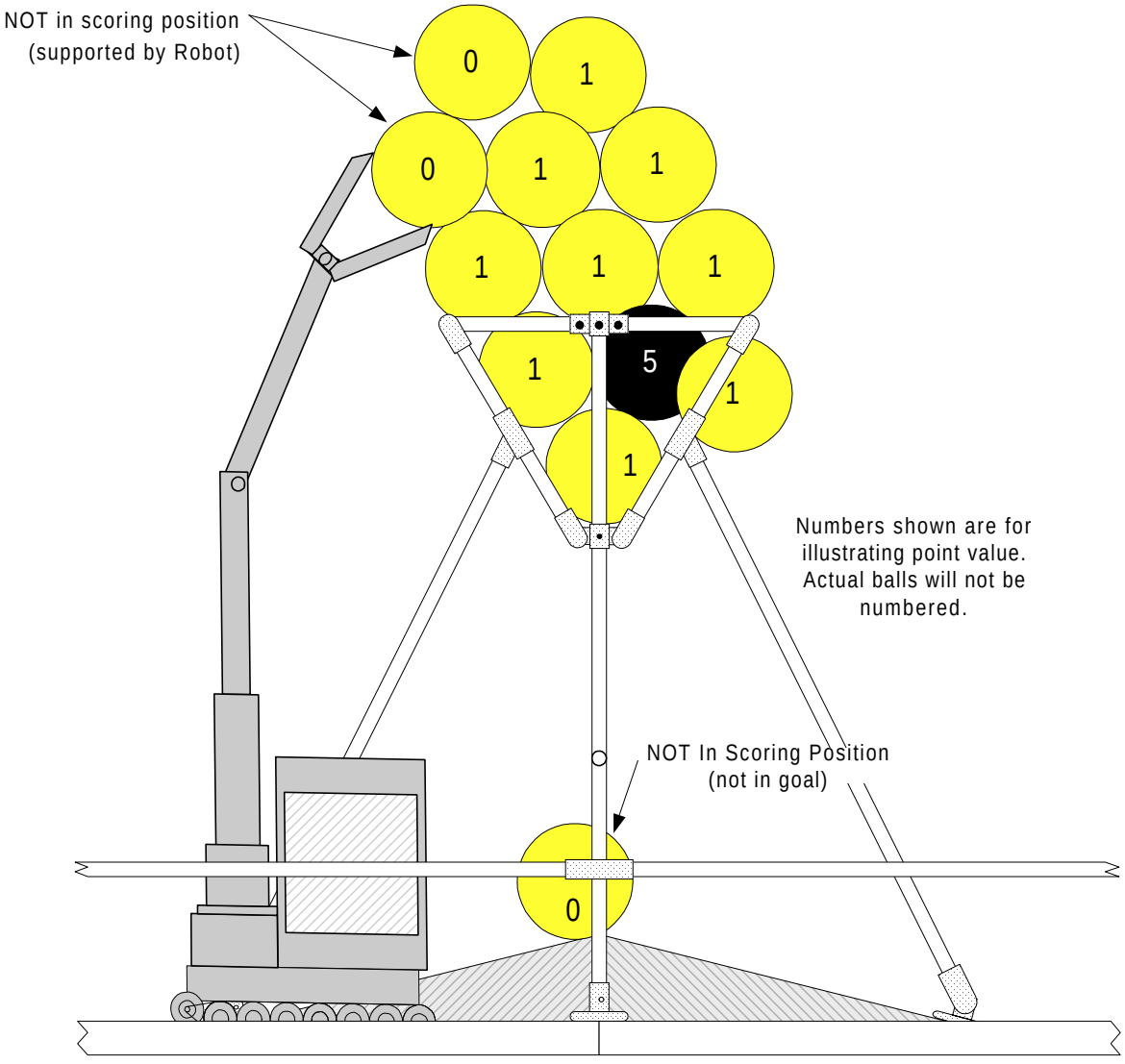

Figure 1.2: Ball Positions and Values

1.2.5 Qualification Point Accumulation

During the qualification matches, all teams accumulate Qualification Points (QPs) which will later be used to help rank the teams.

For a given match, each team in the winning alliance receives triple the match score of the **losing** alliance in QPs. Each team in the losing alliance receives their match score in QPs.

At the conclusion of the qualification matches, the teams will be ranked according to total QPs accumulated. Please read Appendix A for the complete list of game rules including team ranking and ranking tie breakers.

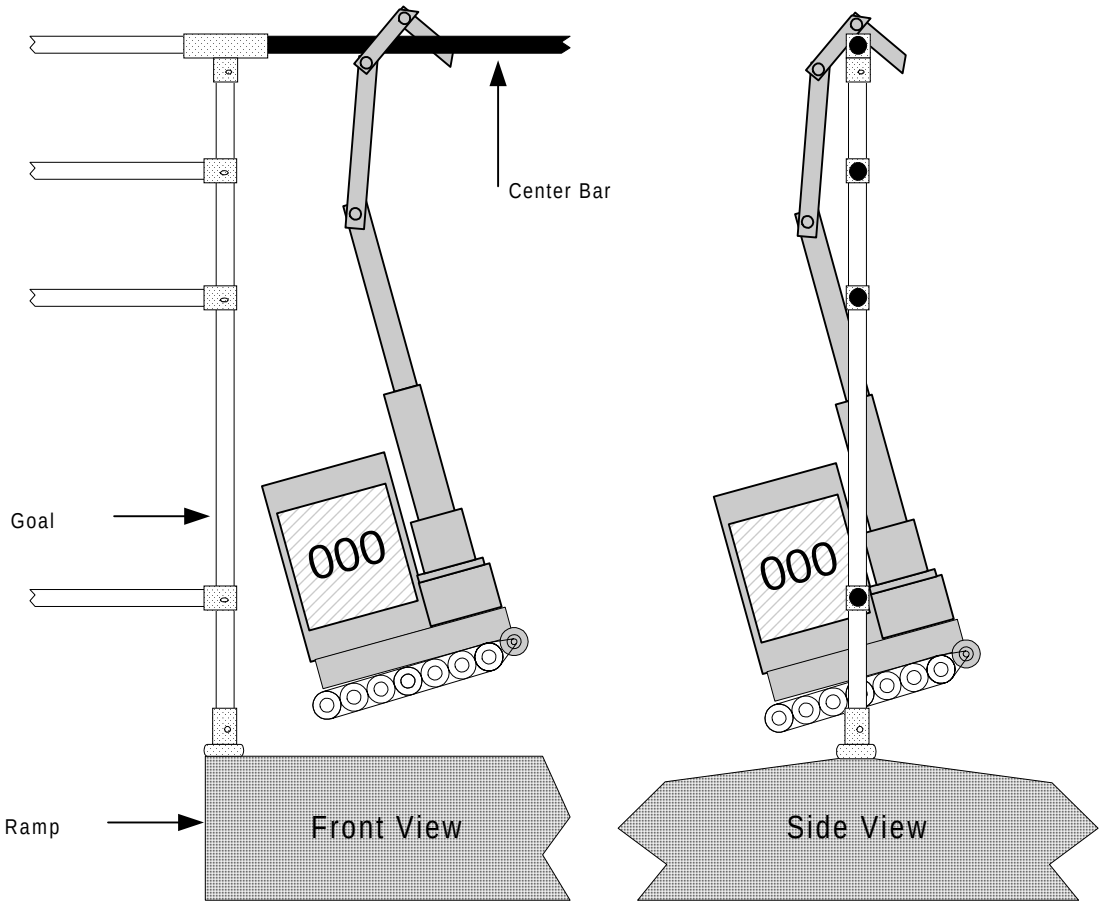

Figure 1.3: Robot Hanging

1.3 Playing Field Construction

1.3.1 PLAYING FIELD DESCRIPTION

The playing field is a carpeted, rectangular area with two fixed goals and a ramp mid-field. At one end of the field are two alliance stations for human players, robot operators and coaches. Prior to the start of each match, balls are placed in specific starting locations on the playing field and in the Alliance Stations, as shown in Figure 1.1.

1.3.2 PLAYING FIELD BORDER

The perimeter of the field is defined by a rectangular curb made of 4x4 lumber. The border assembly rests directly on the carpet. A barrier is constructed from 1-1/4 inch diameter

schedule 40 aluminum pipe and connecting fittings, and is mounted to the top of the 4x4 border with pipe flanges.

The exact dimensions and locations of the various sections, the assembly, and special hardware required are shown in the field parts documentation supplied with the manual at the Kick-Off Workshop.

1.3.3 ALLIANCE STATIONS

There are four Alliance Stations located outside the perimeter of the playing field. These stations are located on either end of the field as shown in Figure 1.1. The opening of the ball chute is located in the center of each alliance station directly above the 4x4 field border. The chute is approximately 2-feet long with a 5° slope. It is constructed of 3/8-inch Lexan so the balls are easily seen.

A transparent safety shield is mounted on top of a diamond plate sheet on the field side of the station for protection of the alliance members. A 6-foot high, transparent wall separates the two alliance stations. The back border of the alliance station will consist of a ½-inch EMT conduit resting directly on the carpeted floor held in place by colored tape. There is a 1-foot by 12-foot shelf made of ¼-inch Aluminum Diamond Plate, 3-feet off the carpeted floor where the alliance's control equipment may be placed. Each alliance station shelf has a pair of 15 pin cables which provide power to the Operator Interfaces or OI, and is plugged into the competition ports of the OI. A pocket for the radio modem and the OI is mounted 3-feet above the shelf. **Teams must bring their own radio and connecting cable to the field.** No additional power outlets will be available.

The human players and coaches are permitted free movement within the alliance station. All alliance members are allowed contact with the balls, however, robot operators and coaches are not allowed to return balls to the playing field.

If a robot operator, human player, or coach has a special need (i.e. requires the use of a wheelchair etc.), please contact FIRST prior to the events. A raised platform will be made available at events as required.

1.3.5 RAMP DESCRIPTION

The ramp is approximately 8-feet wide with a 15° incline rising to 1-foot at the peak. The structure consist of 2x12-inch lumber set 16-inches on center and ¾-inch plywood. The surface of the ramp is covered with the same carpet as the playing field, but in a different color The ramp rests directly on the playing field carpet.

1.3.6 PLAYING FIELD NOTES

The carpet used for the playing field surface and ramp is available from S.S. Mills, Inc. in Dalton, Georgia. The carpet used on the playing field surface is: Brassfield 20, Color-Pewter. The carpet used on the ramp is also Brassfield 20, Color-Black Coal. Contact information for SS. Mills, Inc. is included in the supplier contact listings in "The Robot" section of the manual.

APPENDIX A: RULES

S6 Safety Rules

Safety comes first. Due to the nature of the event in which electrical equipment, springs and tools are used, safety will not be compromised.

S1. ALL TEAMS ARE RESPONSIBLE FOR PROVIDING THEIR OWN SAFETY GLASSES AT EVERY EVENT.

S2. Safety glasses must be worn by all team members in the alliance stations during matches (Robot Operators, Human Players and Coaches).

S3. Safety glasses must be worn by team members when working on their robot in the pit area. They are also highly recommended if adjacent neighboring team(s) are working on their robot(s).

S4. The robot operators, coaches and human players must remain in the alliance stations during the match. They may not reach over the playing field, alliance stations or into the ball chutes.

S5. Robots are not allowed to extend into the ball chute of the alliance station. Incidental contact with the ball chute is acceptable.

S6. If at any time the referees determine that a robot is likely to cause safety hazards in future matches, the robot must be modified to the head referees' satisfaction or it will not be allowed to compete.

S7. Balls are the only projectiles that may be launched by a robot. Latex tubing may be used for the purpose of storing energy to launch balls as long as no more than 5’ is used for this purpose.

S8. **Do not tamper with the power supply, batteries, chargers, speed controllers, joysticks, or any other control system component except as noted in the control system rules.** Tampering could result in failure or malfunction of the control system, and lead to a safety hazard or damage to the robot.

S9. Disconnect the battery from the robot while making adjustments to your robot. Due to the strength of the motors in the Kit, it is important to keep all body parts away from all robot mechanisms while your robot is connected to the battery.

S10. The battery can deliver more than 100 Amperes. Do not let the wires come into contact with any metal surfaces. Route wires carefully to avoid damage and short circuits, which may cause serious burns, fire, and/or permanent destruction of the batteries.

GM General Match Rules

GM1. Referees have ultimate authority during the competition—**THEIR RULINGS ARE FINAL**!

GM2. Teams will be allowed at least 4 minutes between scheduled matches.

GM3. At least 2 minutes prior to the start of each qualification match, teams will be randomly assigned to alliances and given a unique color by FIRST. This color will be used to determine the placement of the alliances’ robots, human players, robot operators & coaches around the playing field. *Figure 1.1 in Section 1.2.3 shows the layout of the playing field including starting positions.*

GM4. Teams will be allowed a maximum of 1 minute to set up their robots on the playing field and a maximum of 1 minute to remove all robot parts from the field following a match. FIRST recommends that teams design their robots to be removed from the playing field without being re-enabled after the match.

GM5. Each match will last for two minutes. It will begin when the control system is enabled and end when it is disabled, unless the match is whistled dead by the referees.

GM6. **ABSOLUTELY NO REMATCHES WILL BE AWARDED.** FIRST reserves the right to **re-play** a match due to obvious catastrophic failure of FIRST provided field materials.

GM7. **NO TIME OUTS WILL BE GIVEN DURING QUALIFYING MATCHES.**

GM8. A team that is unable to field its robot should still field its human player in order to help it's ally.

GM9. During setup for each match, robots may be placed in any orientation within the designated starting area, but may not touch the field border.

GM10. During a match, five members per team (2 - "Robot Operators", 2 - "Coaches", and 1 - "Human Player") are allowed in the designated area at the end of the field. Special badges will be supplied by FIRST at each event and must be worn by these team members for field access.

GM11. Each alliance will start with seven (7) yellow balls & one (1) black ball in the alliance station. Fifteen (15) yellow balls & two (2) black balls will be on the playing field. The playing field balls will be arranged as shown in Figure 1.1 in Section 1.2.3.

GM12. The two robot operators and the human player must be students from a pre-college team partner school.

GM13. During a match, the robots may be operated only by the robot operators and/or by software running in the on-board control system.

GM14. A human player may choose not to return balls to the playing field. However, any balls which leave the alliance station, such as by rolling or being pushed out of the boundaries, will be returned to the playing field area near the alliance station without undue delay.

GM15. There is no limit to the number of balls that may be stored within the alliance stations.

GM16. Human players may use only their bodies to interact with the balls. Special clothing and/or equipment will only be allowed for those who demonstrate a need based on a physical disability.

GM17. Contact with the balls by all alliance members in the alliance stations is acceptable, but only the human players may return balls to the playing field. Balls may only be returned to the playing field by throwing them over the front safety shield.

GM18. If a robot goes out-of-bounds while holding balls and is disabled, the balls that are securely held by the robot will not be returned to the playing field. This is a practical matter designed to prevent damage to the robots and/or balls. If the balls are easily retrieved or fall from the robot to the floor, they will be returned to the playing field without undue delay. *See DA5.*

GM19. Balls which are knocked out-of-bounds will be placed back into play next to the field border near the exit point without undue delay. Balls returned to play will not be fed directly to a robot or human player.

GM20. Referees or field staff are not responsible for damage to trapping devices while attempting to retrieve balls. Please design your robot so that balls may be retrieved quickly and easily after a match is over.

GM21. **Robot shoving will be allowed and is expected to be quite common.** It is very common for machines to run into each other at full speed and get into shoving matches, and for arms and various other mechanisms to experience the resultant forces. This should be taken into consideration when robots are designed and built.

GM22. The outer field barriers are safety features of the playing field. Robots should not be designed to react against them. Incidental contact with the barriers is acceptable. Pushing a ball against a barrier to allow pickup of the ball or passage of the ball to the human player through the ball chute in front of the player station, is acceptable if the forces applied are not sufficient to damage the barrier or otherwise deform the playing field.

GM23. Robots should not be designed to attach or climb on to the goal structure. Robots may only attach to the center cross bar connecting the goals directly above the ramp. Incidental contact with the other sections of the field pipe is acceptable. S*ee Figure 1.3*

GM24. Robots which become entangled in the barriers or goal will not be freed until after the match has finished, unless the entanglement represents a safety hazard.

GM25. Eight (8) alliances at a regional event and sixteen (16) alliances at the National Championship will qualify to advance to the elimination matches. Alliance partners will be chosen as follows:

1. Starting in descending rank order, a representative from each seeded team will select one alliance partner.
2. After all of the first alliance partners have been chosen, the process will start again and each alliance will select their third alliance partner.
3. If one of the top seeds selects another seeded team as an alliance partner, the team with the next highest qualifying points becomes seeded.

GM26. Teams may decline an offer when asked to ally for the elimination matches, however if a team declines they are no longer eligible to be chosen as an alliance partner. In the event that there are not enough eligible teams to complete the number of alliances needed for elimination matches, teams which have declined may only be chosen after all eligible teams.

GM27. Alliances formed for the elimination matches may not be changed for the duration of the event.

GM28. Prior to the start of the elimination matches, one pre-college student member of the highest seeded team from each alliance must be identified to the alliance coordinator as the alliance captain. Each alliance captain must wear an official "Captain Hat" supplied by FIRST.

Alliance Captains are responsible for selecting which two of the three alliance teams will compete in each match, and for keeping the alliance coordinator informed as to their selections.

GM29. At least five minutes prior to the start of the first elimination matches, the alliance captains involved must inform the alliance coordinator which two of their three teams

will compete. Alliance Captains must report team selection at least two minutes prior to the start of each subsequent set of best 2 of 3 matches. Within a set of best 2 of 3 matches, alliance captains must report team selection within two minutes after the referees have allowed teams back onto the field to clear the previous match. There will be a 30 second warning before the selection period expires.

1. Each alliance captain will receive three index cards, one for each team in the alliance. Each card will have an alliance team number written on one side. The alliance captains will communicate their team choices for an upcoming match by delivering/exchanging cards held by the alliance coordinator. Alliance Captains should be careful to hold the index cards so as to shield the team numbers from the sight of the opposing alliance.
2. If an alliance captain does not provide the index cards to the alliance coordinator within the time limits specified above, it will be assumed that the teams fielded by the alliance will not change in the upcoming match.

GM30. The alliance captain will be allowed to stand in the alliance stations assigned to the alliance, regardless of which two of the alliance's teams are competing in the match. If the alliance captain's team is participating in a match, then he/she **must** be a robot operator or human player.

GM31. During the elimination phase of competition, alliances may call a time-out prior to the start of an elimination match. Time-outs may not be called until after the teams competing in the upcoming match have been selected. Team selection may not be changed during or after a time-out.

Time-outs may last up to two and one-half minutes and will be counted in 30 second increments. The cumulative time-outs for both alliances in a match may not exceed two and one-half minutes.

NO TIME-OUTS ARE ALLOWED ONCE PLAY HAS BEGUN.

V Game Violations

V1. Referees have ultimate authority during the competition—**THEIR RULINGS ARE FINAL**. **No recorded replays of the incident will be reviewed by the referees.**

V2. All alliance members must remain in the alliance station during play. If an alliance member steps out of the alliance station for reasons of personal safety, no penalty will be imposed. If an alliance member inadvertently steps over the line, and it does not affect the outcome of the match, then they will receive a minor penalty.

V3. Repeated minor infractions will result in increasingly severe penalties. Penalties will be indicated by referees throwing down flags color coded to the alliance receiving the penalty. Penalties are given to the alliance and not the individual team.

Minor Penalty #1: Warning

Minor Penalty #2: Lose one (1) point

Minor Penalty #3: Lose additional three (3) points

Minor Penalty #4: Lose additional five (5) points

Minor Penalty #5/Major penalty: Disqualification of the alliance

Disqualifying Violations:

If a team is disqualified by a referee, both robots of that alliance will be turned off for the remainder of the match. The human players must cease interacting with balls at the alliance stations, and any points scored by the disqualified alliance during that match will be forfeited.

DQ1. An alliance may not win a match through an advantage gained by breaking a rule, even accidentally.

DQ2. If stepping over the line affects the outcome of the match, such as when throwing a ball that scores or otherwise affects the outcome, then the alliance will be disqualified.

DQ3. Strategies aimed solely at the destruction, damage, tipping over, or entanglement of opponents' robots are not in the spirit of the FIRST Robotics Competition and will not be allowed. Accidental tipping over of an opponent's robot is not considered damaging and will be allowed at the discretion of the referees. Intentional stabbing, cutting, etc., is illegal. If a breach of this rule occurs, the team's alliance will be disqualified for that match.

DQ4. If one alliance damages another alliance's robot in an apparently malicious act, it will result in disqualification of the alliance causing the damage. If the referees determine the damage was not the result of an apparent malicious act, no disqualification will occur.

Determining the intent of a team's actions is a judgment call that will be made by the referees at the time of the action. The safest strategy is to build a tough machine and try to win with strategies and moves that may be aggressive but are not mean spirited. *Refer to V1.*

DQ5. Deliberately damaging the playing field, controls, or balls is strictly illegal and will result in disqualification of your alliance. Robot wheels must not, for example, damage the field carpet. Rounded screw heads implanted in rubber wheels may be OK but screw points are clearly not acceptable. This will be checked during robot inspection at registration on the first event day and throughout the competition. Bunching up or puckering the carpet will be considered as damage to the field.

DQ6. During a match, no team member may intentionally touch any robot, except for reasons of personal safety. If intentional contact is made, the alliance will be disqualified.

DQ7. A robot cannot inhibit the movement of another robot by pinning against a field border, the goal, or the side of the ramp for more than 10 seconds. The team with the pinning robot will be told by the referee to release the robot and back away approximately 3 feet. If the referee determines this rule to be violated the alliance will be disabled.

DQ8. **No remote communication devices, such as air phones, walkie-talkies, etc., may be used by team members at anytime during a FIRST Robotics Competition event.** These devices may cause interference to the remote control signals and malfunction of robots. Teams which are found to violate this rule will be subject to the following penalties.

1. First offense, you will be asked to turn off and store the device.
2. Second offense, the device will be confiscated for the remainder of the event and the offender will not be able to participate in his/her team's next scheduled match.

   Cell phones and pagers are allowed. Remote cameras mounted to a robot are allowed if specific permission is granted by FIRST.

DQ9. No team may build a device, even if it is from Kit parts, to hinder the operation of another team's control system. Disabling an opponent's control system is not in the spirit of the FIRST Robotics Competition, and any alliance caught doing so will be disqualified.

DQ10. For safety reasons, no part of a robot may touch the human players. If this occurs due to an intentional act, the alliance causing the safety hazard will be disqualified. If this occurs by accident, the robot may be disabled if the referee judges the situation to be a safety hazard.

DQ11. For safety reasons, **a robot may only launch balls toward it's own alliance station.** If a violation of this rule occurs due to an intentional act, the alliance causing the safety hazard will be disqualified. If this occurs by accident, the robot causing the safety hazard will be disabled. The referees will decide whether the violation was intentional or accidental.

DQ12. Lifting of an opponents robot off the carpeted floor is a disqualifying offense. Robots are only allowed to pickup their **alliance partner** for scoring purposes.

Disabling Violations:

If a robot is disabled by a referee, the robot is turned off for the remainder of the match, and any points scored during that match will count. The human player may continue to interact with balls at the player station. Their allies may continue to play as normal.

DA1. If a robot accidentally damages the playing field, barriers, balls, or another robot, the referees may disable it for the remainder of the match. If the referees feel that further damage is likely to occur, corrective actions (such as eliminating a sharp edge) will be required to allow the robot to continue competing.

DA2. A robot or human player may not contaminate the playing field, balls, ramp, or another robot with lubricants. If so, the robot or human player will not be allowed to compete until corrective action and approval is given by the head referee.

DA3. Referees may disable any robot that causes a safety hazard during a match.

DA4. A robot may not release any separate part of itself during a match. It must remain whole. If the referee determines a robot has released a part of itself intentionally, the robot will be disabled.

DA5. If a robot goes out-of-bounds to the point that it has to apply force to any out-of-bounds surface to rejoin play, its control system will be disabled. A machine should not be designed to react with an out-of-bounds surface for any reason. *See GM18.*

DA6. For safety reasons, no part of a robot may touch the human players. If this occurs by accident, the robot may be disabled. *See DQ10.*

DA7. For safety reasons, **a robot may only launch balls toward it's own alliance station.** If a violation of this rule occurs by accident, the robot causing the safety hazard may be disabled. The referees will decide whether the violation was intentional or accidental. *See DQ11.*

SC SCoring

Final scoring will begin when all balls come to rest or approximately 10 seconds after the match ends, or upon a referees' decision. This will allow the referees to focus on the balls once the match has ended. Prior to this, the referees may not see all the final ball positions and cannot make accurate scoring decisions. If a robot sags once a match ends and the power is turned off, such that balls move from a scoring position to a non-scoring position, the balls will not score.

SC1. All decisions regarding scoring will be made by the referees. Referees have ultimate authority during the competition—**THEIR RULINGS ARE FINAL**. **No recordings of the match will be reviewed by the referees.**

1. Each alliance will receive one (1) point for each of their yellow balls that is within the goal and not in contact with their robot. Each alliance will receive five (5) points for each black ball that is within the goal and not in contact with their robot. *Refer to Figure 1.2 Ball Positions and Values.*
2. Any robot on the ramp will add five (5) points to its alliance score. A robot is considered "on" the ramp if the robot is touching the ramp and is not applying weight to the flat, carpeted surface of the playing field.
3. Any robot hanging will add ten (10) points to its alliance score. A robot is considered "hanging" if it is not touching the ramp or the playing field surface. A robot is only allowed to attach itself to the horizontal bar directly above the ramp or can be picked up by it's alliance partner. *Refer to Figure 1.3 Robot Hanging.*

SC2. The winner of a match is the alliance with the highest score.

SC3. In the event of a tied score the following tie breaking conditions will be applied, in the order below, until the tie is broken:

1. The alliance with the least penalties or warnings during the match.
2. The alliance with the most robots hanging from the center goal bar.
3. The alliance with the most robots on the ramp.
4. The alliance with the most black balls in their goal.
5. The alliance with the greatest number of balls in a scoring position.
6. The alliance with the robot closest to the center of the top peak of the ramp.

SC4. All teams start each competition event with zero qualification points (QPs), and accumulate QPs throughout the qualifying matches. At the end of each qualifying match, all teams that participated in the match receive QPs as follows:

1. Each team in the winning alliance receives triple the number of match points of the **losing** alliance in QPs.
2. Each team in the losing alliance receives their match score in QPs.
3. If an alliance is disqualified, the other alliance receives triple the winning alliances score in QPs.

SC5. At the conclusion of the qualification matches, each team will drop the QPs earned in their lowest QP match. Teams will be ranked using the following hierarchy of criteria (in order from most to least important):

1. Highest number of Qualification Points.
2. Highest number of matches won during qualification matches.
3. Highest match score.
4. Flip of a coin.

F Notes on Playing Field Construction

F1. All field dimensions listed under playing field construction are specified on the drawings provided with the Manual.

F2. The playing field carpet will rest directly on the floor or a protective floor covering except where otherwise noted.

F3. The ramp will rest directly on the playing field carpet.

