



10 Tournaments

Each 2017 *FIRST* Robotics Competition event is played in a tournament format. Each tournament consists of three sets of MATCHES called Practice MATCHES (not necessarily at all District Events), Qualification MATCHES, and Playoff MATCHES.

Practice MATCHES provide each Team with an opportunity to operate its ROBOT on the FIELD prior to the start of the Qualification MATCHES.

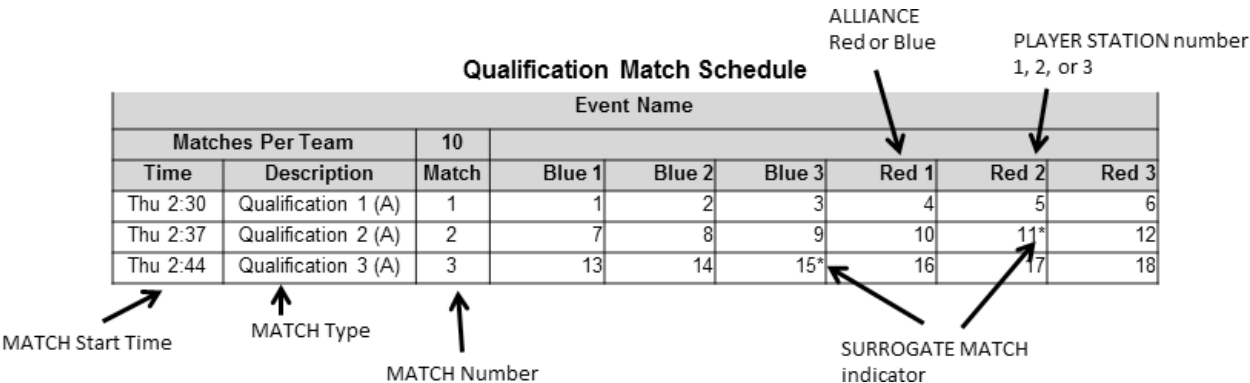
Qualification MATCHES allow each Team to earn a seeding position that may qualify them for participation in the Playoff MATCHES.

Playoff MATCHES determine the event Champions.

10.1 MATCH Schedules

A MATCH schedule is used to coordinate MATCHES at an Event. Figure 10-1 details information shown on each Schedule.

Figure 10-1: Sample MATCH Schedule



10.2 Practice MATCHES

Practice MATCHES are played on the first day of each event. The Practice MATCH schedule is available as soon as possible, but no later than the start of Practice MATCHES. Practice MATCHES are randomly assigned, and teams may not switch scheduled Practice MATCHES. Each Team is assigned an equal number of Practice MATCHES unless the number of Teams multiplied by number of Practice MATCHES is not divisible by six. In this case, the FIELD Management System (FMS) randomly selects some Teams to play an extra Practice MATCH.

Practice MATCHES are not guaranteed at District Events.

10.2.1 Filler Line

A Filler Line is used to fill open slots at events that employ scheduled Practice MATCHES, or all slots at events with an open Practice MATCH schedule. Teams from the Filler Line are used on a first come, first served basis to fill empty spots in Practice MATCHES left by other Teams that do not report to Queueing. The number of Teams in the Filler Line is dependent upon space at venues





- T01.** Teams wanting additional Practice MATCHES may not join the Filler Line unless all criteria listed below are met:
- A.** ROBOTS in the Filler Line must have passed Inspection (this requirement may be waived for events with open Practice MATCH schedules);
 - B.** DRIVE TEAMS must join the Filler Line with their ROBOT;
 - C.** Teams may not work on their ROBOT while in the Filler Line;
 - D.** Teams may not occupy more than one spot in the Filler Line; and
 - E.** If a Team is queued for their Practice MATCH, they may not also join the Filler Line.

10.3 Measurement

The ARENA will be open for at least thirty (30) minutes prior to the start of Qualification MATCHES, during which time Teams may survey and/or measure the FIELD and bring ROBOTS on the FIELD to perform sensor calibration. The specific time that the FIELD is open will be communicated to Teams at the event. Teams may bring specific questions or comments to the FTA.

- T02.** During the period when the ARENA is open for measurement, ROBOTS can be enabled, but cannot move, nor can they interact (e.g. shoot, push, pickup, etc.) with GAME PIECES or the AIRSHIP.

Violation: YELLOW CARD.

10.4 Qualification MATCHES

10.4.1 Schedule

The Qualification MATCH schedule is made available as soon as possible, but no later than one (1) hour before Qualification MATCHES are scheduled to begin. Each Qualification schedule consists of a series of rounds in which each team plays one (1) MATCH per round.

10.4.2 MATCH Assignment

FMS assigns each Team two (2) ALLIANCE partners for each Qualification MATCH using a predefined algorithm, and teams may not switch Qualification MATCH assignments. The algorithm employs the following criteria, listed in order of priority:

1. Maximize time between each MATCH played for all Teams
2. Minimize the number of times a Team plays opposite any Team
3. Minimize the number of times a Team is allied with any Team
4. Minimize the use of SURROGATES (Teams randomly assigned by the FMS to play an extra Qualification MATCH)
5. Provide even distribution of MATCHES played on Blue and Red ALLIANCE
6. Balance assigned PLAYER STATION proximity to a BOILER.

All Teams are assigned the same number of Qualification MATCHES, equal to the number of rounds, unless the number of Teams multiplied by number of MATCHES is not divisible by six. In this case, the FMS randomly selects some Teams to play an extra MATCH. For the purpose of seeding calculations, those Teams are designated as SURROGATES for the extra MATCH. If a Team plays a MATCH as a SURROGATE, it is indicated on the MATCH schedule, it is always their third Qualification MATCH, and the outcome of the MATCH has no effect on the Team's ranking. YELLOW and RED CARDS assigned to SURROGATES do carry forward to subsequent MATCHES.





10.4.3 Qualification Ranking

Ranking Points (RP) are units credited to a Team based on their ALLIANCE'S performance in Qualification MATCHES. Ranking Points are awarded to each eligible Team at the completion of each Qualification MATCH:

- A. Each Team on the winning ALLIANCE receives two (2) Ranking Points.
- B. Each Team on the losing ALLIANCE receives zero (0) Ranking Points.
- C. In the event of a tied score, all Teams receive one (1) Ranking Point.
- D. Each Team on an ALLIANCE that achieves at least 40 kPa receives one (1) Ranking Point.
- E. Each Team on an ALLIANCE that engages all four (4) ROTORS by the end of the MATCH receives one (1) Ranking Point.

Exceptions to A-E are as follows:

- A. A SURROGATE receives zero (0) Ranking Points.
- B. A DISQUALIFIED Team, as determined by the Head REFEREE, receives zero (0) Ranking Points in a Qualification MATCH or causes their ALLIANCE to receive zero (0) MATCH points in a Playoff MATCH.
- C. A "no-show" Team is either DISQUALIFIED from or issued a RED CARD for that MATCH (see C07). A Team is declared a no-show if no member of the DRIVE TEAM is in the ALLIANCE STATION, AIRSHIP, or LOADING LANE at the start of the MATCH.

The total number of Ranking Points earned by a Team throughout their Qualification MATCHES divided by the number of MATCHES they've been scheduled to play (minus any SURROGATE MATCH), then truncated to two (2) decimal places, is their Ranking Score (RS).

All Teams participating in Qualification MATCHES are ranked by Ranking Score. If the number of Teams in attendance is 'n', they are ranked '1' through 'n', with '1' being the highest ranked Team and 'n' being the lowest ranked Team.

Teams are ranked in order, using the sorting criteria defined in Table 10-1.

Table 10-1: Qualification MATCH Ranking Criteria

Order Sort	Criteria
1 st	Ranking Score
2 nd	Cumulative sum of MATCH points
3 rd	Cumulative sum of AUTO points
4 th	Cumulative ROTOR engagement score (AUTO and TELEOP)
5 th	Cumulative TOUCHPAD score
6 th	Total accumulated pressure
7 th	Random sorting by the FMS

10.5 Playoff MATCHES

In Playoff MATCHES, Teams do not earn Ranking Points; they earn a Win, Loss or Tie. Within each series of the Playoff MATCH bracket, the first ALLIANCE to win two (2) MATCHES will advance.





In the case where the Quarterfinal or Semifinal MATCH scores for both ALLIANCES are equal, the Win is awarded to the ALLIANCE per criteria listed in Table 10-2. A DISQUALIFIED Team, as determined by the Head REFEREE, causes their ALLIANCE to receive zero (0) MATCH points in a Playoff MATCH.

In Finals MATCHES, the Champion ALLIANCE is the first ALLIANCE to win two (2) MATCHES. In the case where an ALLIANCE hasn't won two (2) MATCHES after three (3) MATCHES, the Playoffs proceed with up to three (3) additional Finals MATCHES, called Overtime MATCHES, until an ALLIANCE has won two (2) Finals MATCHES. In the case where the Overtime MATCH scores for both ALLIANCES are equal, the win for that Overtime MATCH is awarded based on the criteria listed in Table 10-2.

Table 10-2: Quarterfinal, Semifinal, and Overtime Tiebreaker Criteria

Order Sort	Criteria
1 st	Fewer FOUL points
2 nd	Cumulative sum of AUTO points
3 rd	Cumulative ROTOR engagement score (AUTO and TELEOP)
4 th	Cumulative TOUCHPAD score
5 th	Total accumulated pressure
6 th	MATCH is replayed

10.5.1 ALLIANCE Selection Process

At the end of the Qualification MATCHES, the top eight (8) seeded Teams become the ALLIANCE Leads. The seeded ALLIANCES are designated, in order, ALLIANCE One, ALLIANCE Two, etc., down to ALLIANCE Eight. Using the ALLIANCE selection process described in this section, each ALLIANCE Lead chooses two (2) other Teams to join their ALLIANCE.

If a Team declines the ALLIANCE Lead position or doesn't send a student representative for ALLIANCE selection, they are ineligible to participate in the Playoff Tournament. If the declining/absent Team would have been an ALLIANCE Lead, all lower ranked ALLIANCE Leads are promoted one spot. The next highest-ranked Team moves up to become the ALLIANCE Eight Lead.

Each Team chooses a student Team representative who proceeds to the ARENA at the designated time (typically before the lunch break on the final day of the event) to represent their Team. The designated student representative from each ALLIANCE in a Playoff MATCH is called the ALLIANCE CAPTAIN.

The ALLIANCE selection process consists of two (2) rounds during which each ALLIANCE CAPTAIN invites a Team seeded below them in the standings to join their ALLIANCE. The invited Team must not already have declined an invitation.

Round 1: In descending order (ALLIANCE One to ALLIANCE Eight), each ALLIANCE CAPTAIN invites a single Team. The invited Team's representative steps forward and either accepts or declines the invitation.

If the Team accepts, it becomes a member of that ALLIANCE. If an invitation from a top eight ALLIANCE to another ALLIANCE Lead is accepted, all lower ALLIANCE Leads are promoted one spot. The next highest-seeded, unselected Team moves up to become the ALLIANCE Eight Lead.

If the Team declines, that Team is not eligible to be picked again or to be a BACKUP TEAM (see [Section 10.5.2 BACKUP TEAMS](#)), and the ALLIANCE CAPTAIN extends another invitation to a different Team. If an invitation from a top eight ALLIANCE to another ALLIANCE Lead is declined, the declining Team may still invite Teams to join their ALLIANCE; however, it cannot accept invitations from other ALLIANCES.

The process continues until ALLIANCE Eight makes a successful invitation.





Round 2: The same method is used for each ALLIANCE CAPTAIN'S second choice except the selection order is reversed, with ALLIANCE Eight picking first and ALLIANCE One picking last. This process results in eight (8) ALLIANCES of three (3) Teams each.

Of the remaining eligible Teams, the highest seeded Teams must either accept or decline to be included in a pool of available Teams until there are up to eight (8) Teams that accept to be added into the pool. FIELD STAFF will coordinate the assembly of this BACKUP pool immediately after the top ranked ALLIANCE has made their final pick. If a Team is not available to accept inclusion in the BACKUP pool, it will be assumed they have declined the invitation.

10.5.2 BACKUP TEAMS

In the Playoff MATCHES, it may be necessary for an ALLIANCE to replace one of its members due to a faulty ROBOT. ROBOT faults include but are not limited to:

1. mechanical damage,
2. electrical issues, or
3. software problems.

In this situation, the ALLIANCE CAPTAIN has the option to bring in only the highest seeded Team from the pool of available Teams to join its ALLIANCE. The Team whose ROBOT and DRIVE TEAM replaces another ROBOT and DRIVE TEAM on an ALLIANCE during the Playoff MATCHES is called the BACKUP TEAM.

The resulting ALLIANCE is then composed of four (4) Teams. The replaced Team remains a member of the ALLIANCE for awards, but cannot return to play, even if their ROBOT is repaired.

Each ALLIANCE is allotted one (1) BACKUP TEAM Coupon during the Playoff MATCHES. If a second ROBOT from the ALLIANCE becomes inoperable, then the ALLIANCE must play the following MATCHES with only two (2) (or even one (1)) ROBOTS.

Example: Three (3) Teams, A, B and C, form an ALLIANCE going into the Playoff MATCHES. The highest seeded Team not on one of the eight (8) ALLIANCES is Team D. During one of the Playoff MATCHES, Team C's ROBOT suffers damage to its mechanical arm. The ALLIANCE CAPTAIN decides to bring in Team D to replace Team C. Team C and their ROBOT are not eligible to play in any subsequent Playoff MATCHES. The new ALLIANCE of Teams A, B, and D are successful in advancing to the Finals and win the event. Teams A, B, C, and D are all recognized as members of the Winning ALLIANCE and receive awards

In the case where a BACKUP TEAM is part of the Winning or Finalist ALLIANCE, there will be a four (4)-Team Winning or Finalist ALLIANCE.

10.5.3 Playoff MATCH Bracket

The Playoff MATCHES take place following the completion of the Qualification MATCHES and the ALLIANCE selection process. Playoff MATCHES are played in a bracket format as shown in Figure 10-2.

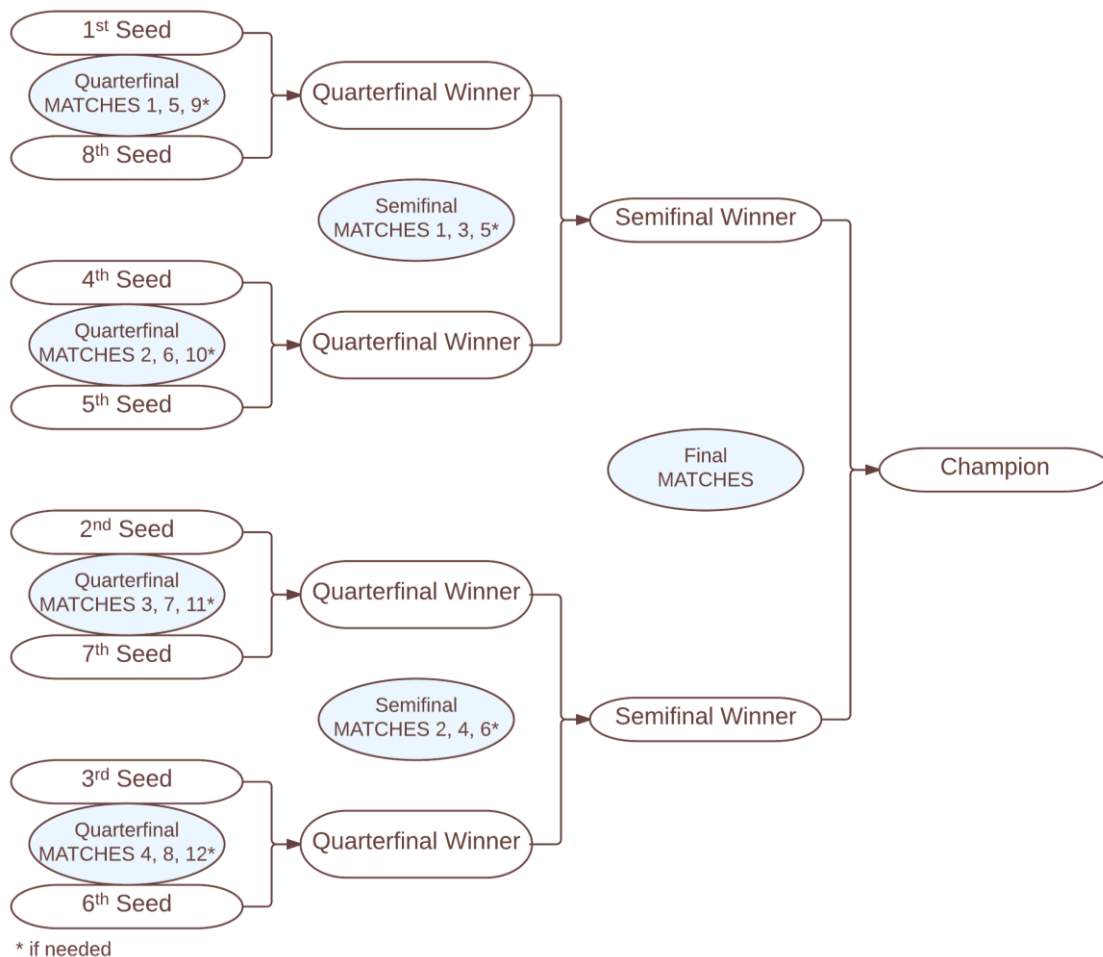
ALLIANCE Leads are assigned to PLAYER STATION 2, the first picks are assigned to the PLAYER STATIONS closer to the BOILER, and second picks are assigned to the PLAYER STATIONS closer to the opponent's LOADING STATION. If a BACKUP TEAM is in play, they will be assigned to the PLAYER STATION that was assigned to the DRIVE TEAM they're replacing.





For Quarterfinal MATCHES, the higher seeded ALLIANCE is assigned to the Red ALLIANCE. Beyond the Quarterfinal MATCHES, the ALLIANCE on the top of each MATCH in Figure 10-2 are assigned to the Red ALLIANCE, regardless of whether they are the higher seeded ALLIANCE in that particular MATCH.

Figure 10-2: Playoff MATCH Bracket





In order to allow time between MATCHES for all ALLIANCES, the order of play is as follows:

Table 10-3: Playoff Order

Quarterfinal Round 1	Quarterfinal Round 2	Quarterfinal Round 3	Semifinals	Finals
Quarterfinal 1 (1 vs.8)	Quarterfinal 5 (1 vs.8)	Quarterfinal Tiebreaker 1 ¹	Semifinal 1	Final 1
Quarterfinal 2 (4 vs.5)	Quarterfinal 6 (4 vs.5)	Quarterfinal Tiebreaker 2 ¹	Semifinal 2	FIELD TIMEOUT
Quarterfinal 3 (2 vs.7)	Quarterfinal 7 (2 vs.7)	Quarterfinal Tiebreaker 3 ¹	Semifinal 3	Final 2
Quarterfinal 4 (3 vs.6)	Quarterfinal 8 (3 vs.6)	Quarterfinal Tiebreaker 4 ¹	Semifinal 4	FIELD TIMEOUT
FIELD TIMEOUT ¹	FIELD TIMEOUT ¹	FIELD TIMEOUT ¹	Semifinal Tiebreaker 1 ¹	Final Tiebreakers (Overtime) ¹
		Any Replays due to ties ¹	Semifinal Tiebreaker 2 ¹	
			FIELD TIMEOUT ¹	Any Replays due to ties ¹
			Any Replays due to ties ¹	

¹ - if required

10.6 REFEREE Interaction

The Head REFEREE has the ultimate authority in the ARENA during the event, but may receive input from additional sources, e.g. Game Designers, *FIRST* personnel, FTA, and technical staff. The Head REFEREE rulings are final. No event personnel, including the Head REFEREE, will review video, photos, artistic renderings, etc. of any MATCH, from any source, under any circumstances.

If a DRIVE TEAM needs clarification on a ruling or score, per C09, one (1) pre-college student from that DRIVE TEAM should address the Head REFEREE after the ARENA Reset Signal (e.g. LED lights turn green). A DRIVE TEAM member signals their desire to speak with the Head REFEREE by standing in the corresponding Red or Blue Question Box, which are located on the floor near each end of the scoring table. Depending on timing, the Head REFEREE may postpone any requested discussion until the end of the subsequent MATCH.

While FMS tracks quantities of FOULS and TECH FOULS, *FIRST* instructs REFEREES to not self-track details about FOULS and TECHNICAL FOULS; as a result, we don't expect REFEREES to recall details about what FOULS or TECHNICAL FOULS were made, when they occurred, and against whom.





Any reasonable question is fair game in the Question Box, and Head REFEREES will do good faith efforts to provide helpful feedback (e.g. how/why certain FOULS are being called, why a particular ROBOT may be susceptible to certain FOULS based on its design or game play, how specific rules are being called or interpreted), but please know that they will likely not be able to supply specific details

10.7 YELLOW and RED CARDS

In addition to rule violations explicitly listed throughout the **2017 Game and Season Manual**, YELLOW CARDS and RED CARDS are used in *FIRST*® Robotics Competition to address Team and ROBOT behavior that does not align with the mission of *FIRST*®.

As noted in [Section 4.4 Rule Violations](#) and C01, the Head REFEREE may assign a YELLOW CARD as a warning, or a RED CARD for DISQUALIFICATION in MATCH for egregious behavior inappropriate at a *FIRST* Robotics Competition event.

T03. Egregious or repeated violations of any rule or procedure is prohibited.

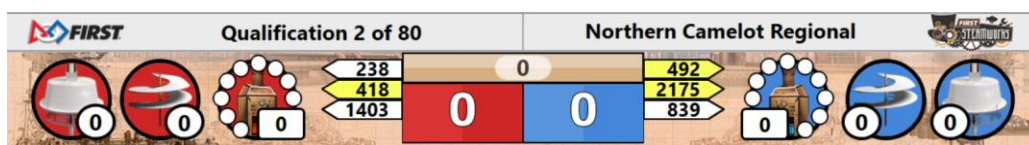
Violation: The Head REFEREE may assign a YELLOW CARD as a warning, or a RED CARD for DISQUALIFICATION in MATCH.

A YELLOW or RED CARD is indicated by the Head REFEREE standing in front of the Team's PLAYER STATION and holding a YELLOW 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. A second YELLOW CARD is indicated by the Head REFEREE standing in front of the Team's PLAYER STATION and holding a YELLOW CARD and RED CARD in the air simultaneously after the completion of the MATCH. A Team that has received either a YELLOW CARD or a RED CARD carries a YELLOW CARD into subsequent MATCHES, except as noted below. A RED CARD results in DISQUALIFICATION.

Once a Team receives a YELLOW or RED CARD, its Team number will be presented with a yellow background on the audience screen at the beginning of all subsequent MATCHES, including any replays, as a reminder to the Team, the REFEREES, and the audience that they carry a YELLOW CARD.

Figure 10-3: Audience Screen Graphic Showing YELLOW and RED CARD Indicators



All YELLOW CARDS are cleared at the conclusion of Qualification MATCHES, providing teams a clean slate at the beginning of Playoff MATCHES.

During the Playoff MATCHES, if a Team receives a YELLOW or RED CARD, it results in the entire ALLIANCE receiving the YELLOW 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.





YELLOW and RED CARDS are applied based on the following:

Table 10-4: YELLOW and RED CARD application

Time YELLOW or RED CARD earned:	MATCH to which CARD is applied:
prior to the start of Qualification MATCHES	Team's first Qualification MATCH
during the Qualification MATCHES	Team's current (or just-completed) MATCH. In the case where the Team participated as a SURROGATE in the current (or just completed) MATCH, the card is applied to the Team's previous MATCH (i.e. the Team's second Qualification MATCH.)
between the end of Qualification MATCHES and the start of Playoff MATCHES	ALLIANCE'S first Playoff MATCH
during the Playoff MATCHES	ALLIANCE'S current (or just-completed) MATCH.

10.8 MATCH Replays

Over the course of the Tournament, ARENA FAULTS may occur. An ARENA FAULT is an error in ARENA operation that includes, but is not limited to:

- A. broken FIELD elements due to
 - i. normal, expected game play or
 - ii. ROBOT abuse of FIELD elements that affects the outcome of the MATCH for their opponents.

A broken FIELD element caused by ROBOT abuse that affects the outcome of the MATCH for their ALLIANCE is not an ARENA FAULT.

For example, a ROBOT that slams into their own LIFT (which has been constructed and assembled per the manual) so hard that the peg breaks, is not considered an ARENA FAULT.

- B. power failure to a portion of the FIELD (tripping the circuit breaker in the PLAYER STATION is not considered a power failure)
- C. improper activation by the FMS
- D. errors by FIELD STAFF
- E. a Team BANNER falling into the FIELD

If, in the judgment of the Head REFEREE, an ARENA FAULT occurs that affects the outcome of the MATCH and any team on the affected ALLIANCE desires a replay, the MATCH will be replayed.

All reasonable effort is made to create the same conditions when replaying a MATCH. This means, for example, that a Team which was BYPASSED during the MATCH which is to be replayed, is BYPASSED for the replay MATCH.

Note that an ARENA FAULT that does not affect MATCH outcome in the judgement of the Head REFEREE does not lead to a MATCH replay. Examples include, but are not limited to:

- A. a piece of FIELD plastic falls into the FIELD in the last 5 seconds of a MATCH, far away from any human or ROBOT activity, and in such a way that it does not affect MATCH outcome



- B. delay in the playing of an ARENA sound
- C. mismatch between the timer on the Audience Screen and the FIELD Timer
- D. any adjustment or delay in assignment of a penalty (including those made after the MATCH)

10.9 TIMEOUTS and BACKUP TEAMS

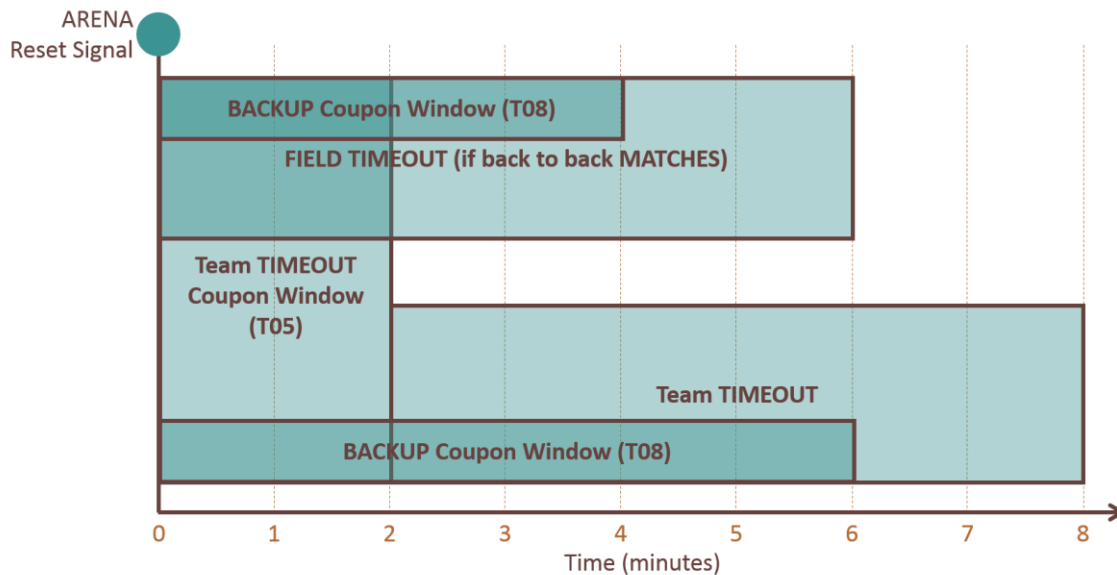
A TIMEOUT is a period of up to six (6) minutes between MATCHES which is used to pause Playoff MATCH progression.

During a TIMEOUT, the ARENA Timer will display the time remaining in the TIMEOUT. Both ALLIANCES will enjoy the complete six (6) minute window. If an ALLIANCE completes their repairs before the ARENA Timer expires, the ALLIANCE CAPTAIN is encouraged to inform the Head REFEREE that they are ready to play. If both ALLIANCES are ready to play before the TIMEOUT expires, the next MATCH will start.

There are no TIMEOUTS in the Practice or Qualification MATCHES.

If circumstances require an ALLIANCE to play in back-to-back MATCHES during the Playoff MATCHES, the Head REFEREE will issue a FIELD TIMEOUT to allow Teams to prepare for the next MATCH. FIELD TIMEOUTS are the same time duration as TIMEOUTS.

Figure 10-4: TIMEOUT Timeline



T04. An ALLIANCE may not call more than one (1) TIMEOUT during the Playoff MATCHES.

Teams are expected to have their ROBOTS staged on the FIELD by the end of the TIMEOUT. Teams that cause a significant delay to the start of a MATCH after a TIMEOUT are subject to 0.

T05. If an ALLIANCE wishes to call a TIMEOUT, the ALLIANCE CAPTAIN must submit their TIMEOUT coupon to the Head REFEREE within two (2) minutes of the ARENA reset signal preceding their MATCH. If there is no preceding MATCH, the TIMEOUT coupon must be submitted no later than two (2) minutes before the scheduled MATCH time. The TIMEOUT will





begin two (2) minutes after the ARENA reset signal (i.e. at the end of the TEAM TIMEOUT Coupon Window depicted in Figure 10-4)

- T06.** There are no cascading TIMEOUTS. If an ALLIANCE calls a TIMEOUT during a FIELD TIMEOUT, the FIELD TIMEOUT will expire two (2) minutes after the ARENA reset signal and the ALLIANCE'S TIMEOUT will begin.

If an ALLIANCE wishes to call a TIMEOUT during a FIELD TIMEOUT, it must still do so within two (2) minutes of the ARENA reset signal preceding their MATCH, per T05.

- T07.** TIMEOUTS are not transferrable between ALLIANCES.

While TIMEOUTS are not transferrable between ALLIANCES, meaning an ALLIANCE cannot hand their designated TIMEOUT coupon to another ALLIANCE to use, an ALLIANCE may use their own coupon for any purpose they wish.

- T08.** If during a TIMEOUT an ALLIANCE CAPTAIN determines that they need to call up a BACKUP TEAM, they must submit their BACKUP TEAM coupon to the Head REFEREE while there are still at least two (2) minutes remaining on the ARENA Timer. After that point, they will not be allowed to utilize the BACKUP TEAM.

Alternatively, an ALLIANCE CAPTAIN may choose to call up a BACKUP TEAM without using their TIMEOUT by informing the Head REFEREE directly within two (2) minutes of the Head REFEREE issuing the ARENA reset signal preceding their MATCH. If there is no preceding MATCH, the BACKUP TEAM coupon must be submitted no later than two (2) minutes before the scheduled MATCH time.

In the case where the ALLIANCE CAPTAIN'S ROBOT is replaced by a BACKUP TEAM, the ALLIANCE CAPTAIN is allowed as a sixteenth ALLIANCE member.

The Head REFEREE will not accept the BACKUP TEAM coupon unless it lists the number of the Team whose ROBOT is being replaced, and is initialed by the ALLIANCE CAPTAIN. Once a BACKUP TEAM coupon is submitted and accepted by the Head REFEREE, the BACKUP TEAM coupon may not be withdrawn by the ALLIANCE.

- T09.** An ALLIANCE may request neither a TIMEOUT nor a BACKUP TEAM after a Playoff MATCH is stopped by the Head REFEREE (e.g. due to an ARENA FAULT or a safety issue). The sole exception is if the replay is due to an ARENA FAULT that rendered a ROBOT inoperable.

If a Playoff MATCH is replayed per T09, the Head REFEREE has the option of calling a FIELD TIMEOUT.

10.10 Pit Crews

During the Playoff MATCHES, extra Team members may be needed to maintain the ROBOT between MATCHES because of the distance between the FIELD and the pit area. Each Team is permitted to have three (3) additional pit crew members who can also help with needed ROBOT repairs/maintenance

- T10.** Pit Crew members may not be in the ALLIANCE STATION during a MATCH.

Violation: MATCH will not start until the situation is corrected. Those not displaying identification must leave the ARENA.





10.II **FIRST®** Championship Additions and Exceptions

At the 2017 *FIRST* Championship, Teams are split into six (6) Subdivisions. Each Subdivision plays a standard Tournament as described in [Section 10 Tournaments](#) to produce the Subdivision Champions. Those six (6) Subdivision Champions proceed to the Championship Playoffs, on the Einstein FIELD, to determine the 2017 *FIRST*® Robotics Competition Champions.

There is no provision for BACKUP TEAMS at the Championship.

10.II.I **Four ROBOT ALLIANCES**

Before each Subdivision Playoff Tournament, ALLIANCES will be selected per the process as described in [Section 10.5.1 ALLIANCE Selection Process](#), however the process will continue with a 3rd round of selection as follows.

Round 3: The same method is used for each ALLIANCE CAPTAIN'S third choice except the selection order is reversed again, with ALLIANCE One picking first and ALLIANCE Eight picking last. This process results in eight (8) ALLIANCES of four (4) Teams each.

ALLIANCES may start with any three (3) of the four (4) ROBOTS on their ALLIANCE during Subdivision Playoff MATCHES and during the Championship Playoffs. The list of three (3) Teams participating in the MATCH and their selected PLAYER STATIONS is called the LINEUP. One representative from the Team not on the LINEUP is allowed as a sixteenth ALLIANCE member.

- T11.** The ALLIANCE CAPTAIN must report the LINEUP to the Head REFEREE, or their designee, in writing prior to end of the preceding MATCH (e.g. the LINEUPS for Quarterfinal 2 must be submitted before the end of Quarterfinal 1). If there is no preceding MATCH, the LINEUP is due no later than two (2) minutes before the scheduled MATCH time.

Violation: The LINEUP is the same as the ALLIANCE'S previous MATCH. If any of these three (3) ROBOTS are unable to play, the ALLIANCE must play the MATCH with only two (2) (or even one (1)) ROBOTS

If an ALLIANCE fails to submit a LINEUP per the process defined in T11 and the MATCH is their first of the Subdivision Playoffs or the Championship Playoffs, the LINEUP will be the ALLIANCE Lead, first ALLIANCE selection, and second ALLIANCE selection. If any of these three (3) ROBOTS are unable to play, the ALLIANCE must play the MATCH with only two (2) (or even one (1)) ROBOTS.

The LINEUP will be kept confidential until the FIELD is set for the MATCH, at which point each ALLIANCE'S LINEUP will appear on the Team Signs.

- T12.** Once the LINEUP has been declared, it cannot be changed unless there is a TIMEOUT. If there is a TIMEOUT, the ALLIANCE CAPTAIN may submit a different LINEUP, but must do so while there are still more than two (2) minutes remaining in the TIMEOUT.

Example: Four (4) Teams, A, B, C and D, form an ALLIANCE going into the Playoff MATCHES on their Subdivision FIELD. During one of the Playoff MATCHES, Team C's ROBOT becomes inoperable. The ALLIANCE decides to bring in Team D to replace Team C. Team C repairs their ROBOT and may play in any subsequent Playoff MATCHES replacing Teams A, B, or D. All four (4) ALLIANCE members are also eligible to play MATCHES during the Championship Playoffs should the ALLIANCE win the Subdivision Tournament.





- T13.** If a MATCH must be replayed due to an ARENA FAULT, the LINEUP for the replayed MATCH is the same as the original MATCH. The sole exception is if the ARENA FAULT rendered a ROBOT inoperable, in which case the LINEUP can be changed.

10.II.2 *FIRST* Championship Pit Crews

FIRST will distribute badges to the ALLIANCE CAPTAINS during the ALLIANCE CAPTAIN meeting, which takes place on the Subdivision FIELDS. These badges will provide the necessary access to the ARENA for pit crew members.

- T14.** Only Team members wearing proper badges are allowed on the ARENA floor during Subdivision and Championship Playoff MATCHES

Violation: MATCH will not start until the situation is corrected. Those not displaying identification must leave the ARENA.

Teams should assume they may be chosen for an ALLIANCE and think about the logistics of badge distribution and set a plan prior to the ALLIANCE selection process. It is each ALLIANCE CAPTAIN'S responsibility to get the Team's badges to the pit crew members.

10.II.3 *FIRST* Championship Playoffs

The six (6) Subdivision Champions play a round-robin style tournament to determine the 2017 *FIRST* Robotics Competition Champions. In this format, each Subdivision Champion plays one MATCH against each of the other Subdivision Champions. The order of MATCHES is shown in Table 10-5.

Table 10-5: Championship MATCH order

MATCH	Houston	St. Louis
Round 1		
1	Carver v Turing	Archimedes v. Tesla
2	Galileo v Roebeling	Carson v. Darwin
3	Hopper v Newton	Curie v. Daly
Round 2		
4	Carver v Roebeling	Archimedes v. Darwin
5	Turing v Newton	Tesla v Daly
6	Galileo v Hopper	Carson v Curie
Round 3		
7	Carver v Newton	Archimedes v. Daly
8	Roebeling v Hopper	Darwin v Curie
9	Turing v Galileo	Tesla v. Carson
Round 4		
10	Carver v Hopper	Archimedes v. Curie
11	Newton v Galileo	Daly v. Carson
12	Roebeling v Turing	Darwin v. Tesla
Round 5		
13	Carver v Galileo	Archimedes v Carson
14	Hopper v Turing	Curie v Tesla
15	Newton v Roebeling	Daly v. Darwin

- T15.** In the Championship Playoffs, ALLIANCES do not earn Ranking Points; they earn Championship Points. Championship Points are units credited to an ALLIANCE based on their performance in each MATCH and are awarded at the completion of each Round Robin tournament MATCH.





- A. The winning ALLIANCE receives two (2) Championship Points
- B. The losing ALLIANCE receives zero (0) Championship Points
- C. In the event of a tied score, each ALLIANCE receives one (1) Championship Point

Exceptions to A-C are as follows:

- D. A DISQUALIFIED Team, as determined by the Head REFEREE, causes their ALLIANCE to receive zero (0) Championship points.

The total number of Championship Points earned by a Team throughout the round robin MATCHES divided by the number of round robin Matches in which they've been scheduled is their Championship Score (CS).

All Teams participating in round robin Matches are ranked by Championship Score. If the number of Teams in attendance is 'n', they are ranked '1' through 'n', with '1' being the highest ranked Team and 'n' being the lowest ranked Team.

Table 10-6: Einstein Tournament Ranking Criteria

Order Sort	Criteria
1 st	Championship Score
2 nd	Cumulative sum of MATCH points
3 rd	Cumulative sum of ROTOR and pressure bonuses
4 th	Cumulative sum of AUTO points
5 th	Cumulative ROTOR engagement score (AUTO and TELEOP)
6 th	Cumulative TOUCHPAD score
7 th	<ul style="list-style-type: none"> • If tie affects which ALLIANCES advance to Playoffs, a tiebreaker MATCH is played between the affected ALLIANCES. • If tie is between ALLIANCES advancing to Playoffs, FMS randomly seeds tied alliances to determine ALLIANCE color.

The two ALLIANCES with the highest Championship Scores at the conclusion of the round robin tournament advance to the Einstein Finals. In the Einstein Finals, ALLIANCES do not earn points, they earn a Win, Loss or Tie. The first ALLIANCE to win two (2) MATCHES is declared the 2017 *FIRST* Robotics Competition Champions.

- T16.** During the Einstein Finals, if the MATCH score of each ALLIANCE is equal, the MATCH is replayed.

10.11.4 *FIRST* Championship TIMEOUTS

There are no TIMEOUTS for teams in the Einstein tournament.

- T17.** Deleted.

10.12 Advancement Between Tournaments

Teams advance through the season depending on the events at which they compete: Regional or District. This section details how teams advance from Regional events to the *FIRST* Championship, or from District qualifying events, to their District Championship, to the *FIRST* Championship.

- T18.** A team is considered to have already earned a *FIRST* Championship invitation prior to the District, Regional, or District Championship if they are:
- A. pre-qualified or





A *FIRST*® Robotics Competition Team listed in the [Championship Eligibility Criteria document](#) is pre-qualified for the *FIRST* Championship if the Team meets one of the following criteria:

- A. member of the *FIRST*® Hall of Fame
- B. an original and sustaining team since 1992
- C. a 2016 *FIRST* Championship winner
- D. a 2016 *FIRST* Championship Engineering Inspiration Award winner

B. met the criteria outlined in T19 at a prior event.

10.12.1 Regional Events

T19. A Team competing at a Regional Event qualifies for the *FIRST* Championship by meeting one of the following criteria:

- A. Winning a qualifying award:
 - i. Regional Chairman's Award
 - ii. Engineering Inspiration Award
 - iii. Rookie All-Star Award
- B. A member of the Winning ALLIANCE
- C. Earning a Wild Card

10.12.2 Wild Cards

Wild cards are used to qualify additional teams for the *FIRST* Championship from Regional events.

T20. All Regional events have a minimum of one (1) Wild Card slot. Additional Wild Cards are generated as follows:

- A. Any team competing at a Regional event that has already qualified for the *FIRST* Championship prior to the Regional, per T18, and earns an additional spot, per T19, generates one (1) Wild Card.
- B. Any team earning two (2) qualifying spots at a single Regional per T19 (e.g. by being on the Winning Alliance and earning the Chairman's Award) generates one (1) Wild Card.
- C. A team who has already earned a spot at *FIRST* Championship prior to their current Regional, per T18, and earns two qualifying spots, per T19, will generate two Wild Card slots.

Wild Card slots are distributed to the Finalist ALLIANCE, in the order of team selection per [Section 10.5.1 ALLIANCE Selection Process](#), until either all Wild Card slots generated at that event are distributed or the Finalist ALLIANCE is out of teams, whichever comes first.

T21. If a member of the Finalist ALLIANCE has already qualified for the *FIRST* Championship, per T18, they are skipped and the next member of the ALLIANCE is awarded the available Wild Card.

T22. Unused Wild Card slots will not be backfilled or replaced.

A Team may decline a Wild Card, but this does not pass the Wild Card slot down to the next available Team. The Wild Card goes unused.





- T23.** Teams selected from the *FIRST* Championship Waitlist to participate at the *FIRST* Championship do not generate Wild Cards.

10.12.3 District Events

District teams are ranked throughout the season based on the points they earn at their first two home District events they attend, as well as at their District Championship. Points are awarded to teams as follows:

Table 10-7: District point assignment

Category	Points
Qualification Round Performance	$QualificationPoints(R, N, \alpha) = \left\lceil InvERF\left(\frac{N - 2R + 2}{\alpha N}\right) \left(\frac{10}{InvERF\left(\frac{1}{\alpha}\right)}\right) + 12 \right\rceil$ <p>(For a typically sized District event, this will result in a minimum of four (4) points being awarded for Qualification round performance. For events of all sizes, a maximum of twenty-two (22) points will be awarded.)</p>
ALLIANCE CAPTAINS	Equal to 17 minus the ALLIANCE CAPTAIN number (e.g. 14 points for ALLIANCE #3 Captain)
Draft Order Acceptance	Equal to 17 minus the Draft Order Acceptance Number (e.g. 12 points for the Team that is 5 th to accept an invitation)
Playoff Advancement	Points awarded based on team participation in individual playoff rounds, and whether or not the ALLIANCE advances. See details below.
Judged Team Awards	<ul style="list-style-type: none"> • 10 points for Chairman's Award • 8 points each for Engineering Inspiration and Rookie All Star Awards • 5 points each for all other judged Team awards
Team Age	<ul style="list-style-type: none"> • 10 points for Rookie Teams • 5 points for second-year Teams

Points earned at District Championships are multiplied by three (3) and then added to points earned at District events, to determine the final season point total for the Team

If there is a tie in the season point total between teams, those items are broken using the following sorting criteria:

Table 10-8: District Team sort criteria

Order Sort	Criteria
1 st	Total Playoff Round Performance Points
2 nd	Best Playoff Round Finish at a single event
3 rd	Total ALLIANCE Selection Results Points
4 th	Highest Qualification Round Seed or Draft Order Acceptance (i.e. Highest ALLIANCE Selection points at a single event)
5 th	Total Qualification Round Performance Points
6 th	Highest Individual MATCH Score, regardless of whether that score occurred in a Qualification or Playoff MATCH
7 th	Second Highest Individual MATCH Score, regardless of whether that score occurred in a Qualification or Playoff MATCH
8 th	Third Highest Individual MATCH Score, regardless of whether that score occurred in a Qualification or Playoff MATCH
9 th	Random Selection

Qualification Round Performance





The calculation of Qualification performance points is done using the equation (an inverse error function) in the table above. The equation utilizes the following variables:

- R – the qualification rank of the team at the event at the conclusion of Qualification MATCHES (as reported by FMS)
- N – the number of *FIRST* Robotics Competition teams participating in the Qualification rounds at the event
- Alpha (α) – a static value (1.07) used to standardize the distribution of points at events

This formula generates an approximately normal distribution of Qualification Round Performance points at an event, based on rank, with most teams getting a moderate number of points, and fewer teams getting the highest or lowest numbers of points available.

Table 10-9 displays sample Qualification Round Performance points for variously ranked teams at a forty (40) team event. The system will automatically generate the appropriate points for each team based on their rank and the number of teams at the event.

Table 10-9 Sample Qualification Round Point assignments

Rank	1	2	3	4	...	19	20	21	...	37	38	39	40
Points	22	21	20	19	...	13	13	12	...	6	6	5	4

10.12.3.1 ALLIANCE Selection Results

This attribute measures both individual Team qualification round seeding performance and recognition by peers.

ALLIANCE CAPTAINS are recognized based on their qualification round seeding rank. This rank is a result of the rules of the game, which typically incorporate several team performance attributes, and are designed to eliminate ties in rank. Non-ALLIANCE CAPTAINS are rewarded based on peer recognition. To be invited to join an ALLIANCE, a Team's peers have decided that the Team has attributes that are desirable. Giving points for ALLIANCE selection also supports come-from-behind Teams. A Team taking several MATCHES to optimize their performance may be recognized as a late bloomer by a top seeded Team, even if that performance isn't reflected in the rankings because of poor performance in early MATCHES. These points also have the potential to recognize Teams employing a minority strategy with their ROBOT. Teams with unique or divergent ROBOT capabilities that complement the strengths of other ALLIANCE members may be selected to fill a strategic niche.

Note also that ALLIANCE CAPTAINS are given the same number of points as the Team drafted in the same sequence. For example, the third ALLIANCE CAPTAIN gets the same number of points as the third draft. Numerical analysis supports the idea that ALLIANCE CAPTAINS are about as strong in ROBOT performance as equivalently drafted Teams. As an additional minor benefit, awarding the same points for ALLIANCE CAPTAINS and equivalent drafts lubricates the acceptance of draft offers between ALLIANCE CAPTAINS, which gives Teams out of the top eight the chance to experience being ALLIANCE CAPTAINS themselves.

10.12.3.2 Playoff Round Performance

This attribute measures Team performance as part of an ALLIANCE.

All Teams on the ALLIANCE winning a particular playoff series, who participate in MATCHES with their ROBOTS, receive five (5) points per MATCH won. In most cases, Teams receive ten (10) points at each of the Quarterfinal, Semifinal, and Final levels, unless a BACKUP ROBOT is called in to play.

10.12.3.3 Awards

This attribute measures Team performance with respect to Team awards judged at the event.





The points earned for Team awards in this system are not intended to capture the full value of the award to the Team winning the award, or to represent the full value of the award to *FIRST*. In many ways, the Team's experience in being selected for awards, especially the Chairman's Award, the Engineering Inspiration Award, and the Rookie All Star Award, is beyond measure, and could not be fully captured in its entirety by any points-based system. Points are being assigned to awards in this system only to help Teams recognize that *FIRST*® continues to be "*More than Robots*®," with the emphasis on our cultural awards, and to assist in elevating award-winning Teams above non-award winning Teams in the ranking system.

Teams only get points for Team awards judged at the event. If an award is not judged, e.g. Rookie Highest Seed, is not for a Team, e.g. the Dean's List Award, or is not judged at the event, e.g. Safety Animation Award, sponsored by UL, no points are earned.

10.12.3.4 Team Age

This attribute recognizes the difficulty in being a Rookie or second-year Team.

Points are awarded to Rookie and second year Teams in recognition of the unique challenges Teams face in those early years, and to increase the chance that they will make it to the District Championship to compete with their ROBOTS. Like our dedicated Rookie awards, these additional points are intended to recognize and motivate newer participants in *FIRST*® Robotics Competition. These points are awarded once at the beginning of the season. Rookie year is calculated based on the year in which *FIRST* recognizes the Team as a Rookie.

10.12.3.5 Regional Participation

District Teams do not earn points for their actions at any Regionals they may attend, nor are eligible for *FIRST* Championship qualifying judged awards at those events. However, if a District Team does earn a slot at the *FIRST* Championship while attending a Regional event, that slot does count as part of the total Championship allocation the District is receiving for the season.

10.12.3.6 District Championship Eligibility

T24. A Team competing in a District qualifies for their District Championship by meeting one of the following criteria:

- A. District Chairman's Award winner
- B. District Ranking; based on total points earned at their first two home District events as detailed in [Section 10.12.3 District Events](#).

Teams do not earn points at third or subsequent District events, nor at any inter-district or Regional events at which they compete during the 2017 season.

If a team declines an invitation to the District Championship, the next highest uninvited team on the list is invited, and so on, until the event capacity is filled.

- C. District Engineering Inspiration winner (qualifies to compete for the award only)
- D. District Rookie All Star winner (qualifies to compete for the award only)

The capacity of each District Championship is shown in Table 10-10. Each District determines the number of teams which qualify for their District Championship. These limits are based on factors including but not limited to the total number of teams in the District, available venue capacity, etc.





Table 10-10: 2017 District Championship Capacities

District Championship	2017 Team Capacity
Chesapeake District Championship	58
Indiana State Championship	32
Israel	45
Michigan State Championship	160
Mid-Atlantic Robotics District Championship	60
New England District Championship	64
FIRST North Carolina State Championship	32
FIRST Ontario Provincial Championship	60
Pacific Northwest District Championship	64
Peachtree District State Championship	45

10.12.3.7 FIRST® Championship Eligibility for District Teams

Districts receive the percentage of 'available slots' at their assigned FIRST Championship location, rounded up to the nearest whole slot, equal to the percentage of teams they have in their District compared to the total of all FIRST Robotics Competition teams in the current season who would normally be assigned to their FIRST Championship location. 'Available slots' are calculated by taking the total number of slots at each FIRST Championship location, subtracting the number of pre-qualified teams assigned to that location, and also subtracting a 10% allowance for waitlisted teams, as Districts are still allowed to send waitlisted teams to the FIRST Championship. Further, this overall calculation uses a 'snapshot' of teams that have registered and paid as of a specific day a week or so after season payment due.

These slots are guaranteed to the Districts and populated with the following teams:

- qualifying award winners from the District Championship (Chairman's Award, Engineering Award, and Rookie All Star winners),
- teams on the Winning Alliance from the District Championship (including any Back-Up teams participating),
- qualifying award winners among district teams who traveled to Regionals,
- teams on the final District ranking list, as deep in the ranking list as the District needs to go to fill their allocation.

If a District team earns a slot to the FIRST Championship within the season, but is not able to attend, the top ranked team who has not yet been offered a slot is given the opportunity, and so on, until all slots are filled. Slots for pre-qualified teams will not be backfilled.

Districts determine the number of Dean's List, Chairman's, Rookie All Star, and Engineering Inspiration Awards to present at their Championship, within a range established by FIRST and shown in Table 10-11.





Table 10-11: District slot allocations for FIRST Championship

FIRST Championship Normalized Slots FIRST Championship Slots			Chairman's Award			Dean's List Award			Engineering Inspiration Award			Rookie All Star Award		
			District Selection			District Selection			District Selection			District Selection		
			Max Ratio	Min Ratio		Max Ratio	Min Ratio		Min	Max		Min	Max	
FIRST Championship St. Louis														
FIRST Chesapeake	23		1	3	2	3	4	4	1	2	2	1	2	1
FIRST in Michigan	82		5	9	5	9	14	14	1	2	1	1	2	2
Indiana FIRST	10		1	1	1	2	2	2	1	2	1	1	2	1
Mid-Atlantic Robotics	22		1	2	2	2	4	4	1	2	2	1	2	1
New England	37		2	4	4	4	6	6	1	2	2	1	2	2
Ontario	29		2	3	3	3	5	5	1	2	1	1	2	1
FIRST Championship Houston														
FIRST Israel	16	13	1	1	1	2	2	2	1	2	2	1	2	1
FIRST North Carolina	15	12	1	1	1	2	2	2	1	2	2	1	2	1
Pacific Northwest	39	32	2	4	3	4	5	5	1	2	2	1	2	2
Peachtree	18	15	1	2	1	2	3	3	1	2	2	1	2	1

All Districts, regardless of Championship Slot allocation, may award one (1) or two (2) Engineering Inspiration and Rookie All-Star Awards.

Chairman's Award and Dean's List Award maximums and minimums are determined by ratios applied to a given District's Championship Slot allocations. However, Districts assigned to Houston have relatively larger Championship slot allocations for a given team count compared to Districts assigned to St. Louis, and we did not want these larger allocations to skew award allocations. So, for the purposes of award allocations only, Championship slots for Houston Districts were 'normalized', as shown in the table, reducing the slots allocated to what they would have been if both Championship geographies had the same total number of FIRST Robotics Competition teams. This 'normalized' slot allocation was then used to determine award minimums and maximums. As noted, these normalized slot values are used only for award allocations. The Houston-assigned Districts still retain the full Championship Slots Allocated (the larger number) shown in the table.

10.13 Festival of Champions Additions & Exceptions

At the 2017 Festival of Champions, ALLIANCES representing FIRST Championship Houston and FIRST Championship St. Louis will meet in competition.

The ALLIANCE first winning three (3) MATCHES will be declared the winner of the event. If the MATCH score of each ALLIANCE is equal in any given MATCH, the MATCH is replayed.

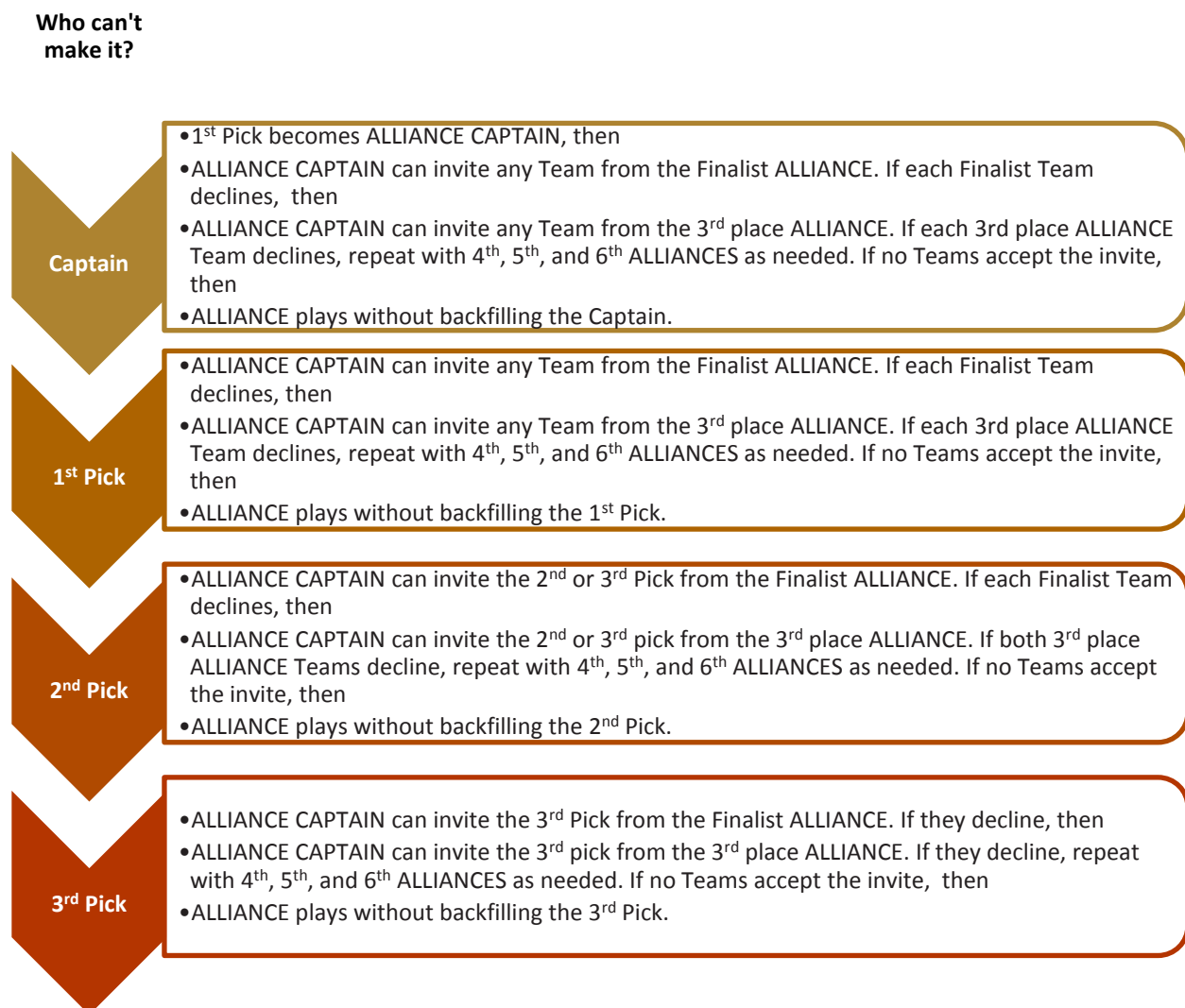
ALLIANCES for the 2017 Festival of Champions will consist of the winning ALLIANCE at FIRST Championship Houston and the winning ALLIANCE at FIRST Championship St. Louis (all four (4) TEAMS from each).





Should a team from a winning ALLIANCE at a *FIRST* Championship location not be able to attend the 2017 Festival of Champions, the ALLIANCE CAPTAIN of that ALLIANCE may invite a team per Figure 10-5.

Figure 10-5 : Festival of Champions Backfill Process



All relevant rules under Section 10.11.1 Four ROBOT ALLIANCES, four-ROBOT ALLIANCES, will continue to be followed at the 2017 Festival of Champions.

As a practical matter, we will not be able to inspect for every modification TEAMS may have made to their ROBOTS after their participation on Einstein. However, the intent of these rules is to help make sure the ROBOTS that participate in the Festival of Champions are reasonably similar to the ROBOTS that participated in Einstein, with allowances for improvements in software. As with many *FIRST* Robotics Competition rules, we are relying on our TEAMS' Gracious Professionalism in making the Festival of Champions a fun and fair competition.





All rules in Section 9 Inspection & Eligibility Rules apply, except there is no 'bagging' requirement for the ROBOTS used in competition at the Festival of Champions. Additionally, the following rules apply:

T25. TEAMS must compete in each MATCH with the same ROBOT they competed with at *FIRST* Championship, as configured for their ALLIANCE'S final MATCH. In other words, TEAMS may not add mechanical or sensor functionality to their ROBOTS for or during the Festival of Champions, including, but not limited to:

- E.** New functionality
- F.** Redesigned/enhanced mechanisms
- G.** New sensors

T25 does not prohibit changes to or additions of software, the OPERATOR CONSOLE, or non-functional decorations. It also does not restrict any activities including off-season event participation, outreach, demonstrations, or practice.

TEAMS may make any necessary repairs to their ROBOTS. This includes the repair or replacement of damaged or non-functioning parts.

Teams may modify their ROBOT in any way they wish for non-Festival of Champions activities, but any changes not compliant with this section must be undone prior to participation in the Festival.

TEAMS may collaborate on the allowed activities above with any other TEAMS or resources they choose.

T26. ROBOTS used at the Festival of Champions must remain compliant with all ROBOT rules except R17.

Teams participating in the Festival of Champions that have any questions on these rules should email frcteamadvocate@firstinspires.org. If you are unsure whether or not an action you are considering with your Einstein ROBOT is legal, please ask.

