



FIRST[®] Tech Challenge

FIRST TECH CHALLENGE

2013 - 2014 GAME MANUAL PART 1:

TOURNAMENT INFORMATION, AWARDS, AND ROBOT RULES



Cover photo courtesy of George Marchant.

IMPORTANT NOTICE:

THE GAME MANUAL PART 2 INCLUDES A DESCRIPTION OF THE GAME AND GAME RULES. THE GAME MANUAL PART 2 WILL BE RELEASED ON SEPTEMBER 7, 2013.

TEAMS MUST COMPLY WITH ALL RULES AND REQUIREMENTS STATED IN THIS DOCUMENT AND IN PART 2 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. FORUM RULINGS TAKE PRECEDENCE OVER INFORMATION IN THE MANUALS FOR THIS SEASON.

Revision History		
Rev	Date	Description
1	July 1, 2013	Initial Release
1.1	October 30, 2013	<ul style="list-style-type: none">• Section 3.2 – Additional Tournament definitions• Section 3.6.7 – Clarified RP received in the event of a tie match• Section 3.9 – Added Rule <T7>• Section 5.2.2 – Clarification to rule <R05>d – servo blocks listed are the only allowed servo blocks• Section 5.2.2 – Rule <R05>o – Added information about legal wheel hubs

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1.0 Introduction

About *FIRST*®

“...to create a world where science and technology are celebrated... where young people dream of becoming science and technology heroes.”

Dean Kamen, Founder, *FIRST*

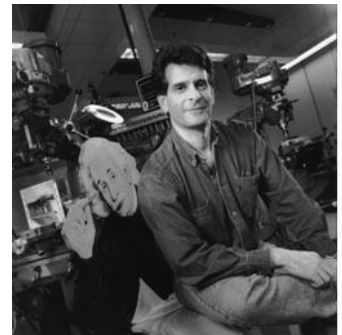
FIRST® (For Inspiration and Recognition of Science and Technology) was founded by inventor Dean Kamen to inspire young people’s interest and participation in science and technology. Based in Manchester, New Hampshire, *FIRST* is a 501(c)(3) not-for-profit public charity.

As a volunteer-driven organization, *FIRST* is built on partnerships with individuals as well as businesses, educational institutions, and government. Some of the world’s most respected companies provide funding, mentorship time and talent, and equipment to make *FIRST*’s mission a reality. As a team coach, you join over 120,000 committed and effective volunteers who are key to introducing over 300,000 young people to the joy of problem solving through engineering.

FIRST provides four programs: the *FIRST* Robotics Competition (FRC®) for grades 9-12, the *FIRST* Tech Challenge (FTC®) for grades 7-12; *FIRST* LEGO® League (FLL®) for 9 to 14 year-olds, and Junior *FIRST* LEGO League (Jr.FLL®) for 6 to 9 year-olds. Also located at *FIRST* headquarters is the research and development facility called *FIRST* Place™. *FIRST* Place is integral to game design, new program development, evaluation, and professional development of *FIRST* mentors.

“We want to change the culture by celebrating the mind. We need to show kids that it’s more fun to design and create a video game than it is to play one.”

Dean Kamen,
Founder, *FIRST*



Dean Kamen is President of DEKA Research & Development Corporation; a dynamic company focused on the development of revolutionary new technologies that span a diverse set of applications. As an inventor, physicist, and entrepreneur, Dean has dedicated his life to developing technologies that help people lead better lives. Dean’s proudest accomplishment is founding *FIRST*.

2.0 What is *FIRST* Tech Challenge?

FIRST Tech Challenge (FTC) had its beginnings in 2005 and grew out of a need for a mid-level robotics program to transition teams from *FIRST*® LEGO® League to the *FIRST*® Robotics Competition. Piloted for two years as the *FIRST* Vex Challenge, FTC became an official *FIRST* program and was renamed *FIRST* Tech Challenge in 2007.

FIRST Tech Challenge is a student-centered activity that is mentor supported and is about giving students a unique and stimulating experience. We want students to learn the value of teamwork and to respect everyone's ideas and contributions to the team. *FIRST* Tech Challenge allows high school students to work hand-in-hand with technical professionals to develop a solution to the annual challenge. The students do a majority of the work, but the mentor is there to offer guidance, suggestions, and coaching to keep the students on task and successful. *FIRST* values are about appreciating our differences and learning what those differences add to our lives. *FIRST* programs succeed most fully when team members bring the *FIRST* values they learn back to their communities.

The FTC Competition Kit challenges students' creative problem-solving skills by enabling them to build robots that do amazing things. When you bring dedicated, enthusiastic students and a mentor together, the results can be phenomenal! Students design and construct robotic devices which can be autonomously programmed or operator-controlled to perform various tasks.

FIRST Tech Challenge teams receive each year's game during a September Kickoff. The game's rules and regulations are provided on the www.usfirst.org website.

2.1 Gracious Professionalism™ – A *FIRST* Credo

Dr. Woodie Flowers, National Advisor for *FIRST*, speaks about Gracious Professionalism™ in this way: "The *FIRST* spirit encourages doing high-quality, well informed work in a manner that leaves everyone feeling valued. Gracious Professionalism seems to be a good descriptor for part of the ethos of *FIRST*. It is part of what makes *FIRST* different and wonderful."

Gracious Professionalism can and should mean different things to each of us. It is possible however, to outline some of its meanings:

- ❖ Gracious attitudes and behaviors are 'win-win.'
- ❖ Gracious folks respect others and let that respect show in their actions.
- ❖ Gracious professionals make a valued contribution in a manner pleasing to others and to themselves as they possess special knowledge and are trusted by society to use that knowledge responsibly.

As Woodie says, "In the long run, Gracious Professionalism is part of pursuing a meaningful life. One can add to society and enjoy the satisfaction of knowing that you have acted with integrity and sensitivity. That's good stuff!"

"In *FIRST*, Gracious Professionalism means that we learn and compete like crazy, but treat one another with respect and kindness in the process. We try to avoid leaving anyone feeling like they have lost. No chest-thumping barbarian tough talk, but no sticky sweet platitudes either. Knowledge, pride and empathy comfortably blended."

3.0 The Tournament

3.1 Overview

The *FIRST* Tech Challenge is played in a tournament format. Each tournament includes qualifying and elimination

matches. After the qualifying matches, teams are ranked based on their match performance. The top-ranked teams select alliance partners and participate in the elimination matches to determine the event champions.

This section provides a general summary regarding a *FIRST* credo, mascots, uniforms, recommended items and equipment for teams to bring, pit rules, event schedules, registration, practice rules and time slots, and robot inspections. Please read the following to get a feel for competition schedules, registration procedures, practice times, and matches.

3.2 Tournament Definitions

Alliance – Each FTC match is comprised of two, two-team Alliances. At events with more than 20 teams, the semi-final and final round Alliances are made up of three teams each. However, only two of those teams compete during any one match.

Alliance Captain – The student representative from an Alliance’s highest ranked team chosen to represent an Alliance during Alliance Selection and for the final Elimination Matches. The entire team may also be referred to as the Alliance Captain.

Alliance Selection – The process by which top-ranked teams choose Alliance Partners for the Elimination Matches.

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

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

Elimination Match – A match used to determine the Winning Alliance. Alliances of two or three teams face off in a series of matches, with two teams per alliance playing in each match. The first alliance to win two matches proceeds to the next round.

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

Practice Match – A match used to provide time for teams to get acquainted with the official playing field.

Qualifying Match – A match used to determine the teams that qualify for the Alliance Selection and move on to the Elimination Matches. Alliances compete to earn Qualifying Points and Ranking Points.

Qualifying Points (QPs) – The first basis for ranking teams, Qualifying Points are awarded for winning (two points) and tying (one point) a Qualifying Match.

Ranking Points (RPs) – The second basis of ranking teams, Ranking Points are used as the tiebreakers when teams have equal Qualifying Points. Ranking Points are awarded in the amount of the final score of the losing Alliance in a Qualifying Match. Both Alliances receive the pre-penalized score of the losing Alliance as their RP.

Surrogate Match – An additional Qualifying Match for some teams depending on the number of teams in the tournament. A Surrogate Match will not count in the standings for Qualifying Points or Ranking Points to the teams that are marked as playing as surrogates. However, these matches are very important in the entire standings and should be played by all as if they were regular Qualification Matches. Surrogate Matches will be marked as such on the official Qualifying Match schedule.

3.3 Tournament Event Schedule

Event schedules will be available through your Tournament Host prior to or at your tournament. Qualification Match schedules are created on tournament day by the scoring system after all teams have checked-in and have completed the inspection process.

3.4 Courtesy and Rules

You will hear the expression Gracious Professionalism (GP) often throughout your involvement in FTC. One of FTC's main goals is to encourage all team members to conduct themselves with kindness, consideration, and sharing. We hear heartwarming stories of teams sharing parts, helping to build or repair competing robots, and helping rookie teams avoid preventable pitfalls. These examples of GP are some of the benefits of being involved with this organization. Please display GP throughout the event.

The pit is where the behind-the-scenes action takes place. The *FIRST* staff and volunteers want you to enjoy the competition. Follow the rules below while in the pit as well as in the audience so everyone can work and compete in a safe, sportsmanlike, friendly, and orderly manner.

Bands: No live bands are allowed in the audience or pit.

Battery Safety: Charge your batteries in an open, well-ventilated area.

Fire Extinguishers: These are usually located at the pit administration station and in the competition area.

Food: Check with the event organizer before bringing food to an event, as some venues will not allow outside food on-site due to contracts and agreements.

Internet/Wireless Network Access: Teams may not setup a wireless computer network for any purpose (i.e. Internet access, team communication, team computer to robot, etc.). Teams are required to use the wireless computer network provided by the Tournament Organizers or venue for all robot communication. Internet access for the teams will be at the discretion of the Tournament Director.

Music/Noise: No loud music, audio systems, whistles, banging sticks, blow horns, etc. allowed. They prevent teams from hearing important announcements. Power may be shut off and/or noisemakers confiscated.

Painting: There is no painting in the pit.

Pit Displays: Pit display structures may not exceed ten (10) feet in height.

Radios/Walkie-Talkies: Teams are not allowed to use radios and walkie-talkies anywhere in the tournament facility.

Running: There is no running in the pit.

Sales: Because of site regulations/contracts, *FIRST* cannot allow teams or individuals to sell items, such as T-shirts, pins, etc., at any events. Fundraising for a cause is permitted; fundraising for a team is not permitted.

Seat Saving: Sitting together in a group during competition matches makes the game more exciting and fun. It allows you to show support for your team. Teams are not allowed to save seating space as there is often not enough seating to accommodate everyone.

Team Safety Captain: Each team appoints a safety captain who will help maintain safety at events, especially in the pit. He or she will remind attendees about the safety rules listed here.

Soldering, Gluing, Brazing, or other Large Power Tools: These activities and tools are not allowed in the pit areas or at the competitions unless the tournament director specifically allows them.

3.5 Eye Protection and Safety

FIRST requires all teams to bring and supply ANSI Z87.1 certified safety glasses for their members and guests for each competition. Regular glasses and sunglasses do not qualify as safety glasses. If you wear prescription glasses, you must wear safety goggles over them or attach safety side shields. For our purposes, amber lenses that allow for enhanced vision are considered tinted, not shaded, and their use is allowed at *FIRST* events. Sunglasses or deeply shaded safety glasses used in our indoor event environment are not acceptable.

Students, adult team members, and guests must wear eye protection while working on the robot, when observing robot building/repair work, while in the pit area, and in the competition area. Teams without eye protection are not allowed in the competition area.

Open-toed or open-backed shoes are not permitted in the pit area or in the competition area.

3.6 Tournament Day Overview

FTC events pack a lot of activities into one day. The main events for a typical tournament are:

1. Team Check-in
2. Robot Hardware and Software Inspection
3. Judges' Interviews
4. Drivers' Meeting
5. Practice Matches
6. Opening Ceremony
7. Qualification Matches
8. Alliance Selection
9. Elimination Matches
10. Awards and Closing Ceremony

3.6.1 Team Check-In

As a team arrives at the venue, the Coach or other adult mentor should register the team with the tournament officials. During check-in, the Coach will receive a packet of information for the team that may include drive team badges, a judging schedule, a map of the facilities and pits, and other information that is very important to the teams. The Coach should review all the material to make sure the packet is complete. At this time, the team should set up their Pit area and get familiar with the venue, including where the practice and playing fields are and where judging takes place, and review the schedule of events for the day.

3.6.2 Robot Hardware and Software Inspection

FTC robots are required to pass hardware and software inspections before being cleared to compete. These inspections ensure that all FTC robot rules and regulations are met. A copy of the official FTC "Robot Inspection Sheet" is located in Appendices 1 and 2. The "Robot Inspection Sheet" must be used by teams as a guide to pre-inspect their robot. A Bill of Materials (BOM) of non-TETRIX, non-MATRIX, or non-LEGO parts must be presented at Hardware Inspection.

3.6.3 Judges' Interviews

At *FIRST* Tech Challenge events, there are generally three parts to the judging process: 1) interview with judges; 2)

evaluation of performance during the tournament; and 3) evaluation of the Engineering Notebook. Each team will have a ten to fifteen minute “fact finding” interview with a panel of two or three judges.

The Judges’ Interviews generally take place before any qualification matches so that the entire team may be interviewed. When teams arrive at the event, the interview schedule should be included in the registration materials. Make sure you know when your team will be interviewed and arrive to the interview room early. Please have at least two student team representatives and the robot available; the entire team is encouraged to participate. Mentors (no more than two) are welcome to observe the Judges’ Interview at most events, but should not participate (see Section 7.4 for more details).

3.6.4 Drivers’ Meeting

The Drivers’ Meeting takes place prior to the start of qualification rounds and is a time when the drive team meets with the referees. During this time, the head referee gives a brief overview of what is expected of teams and any venue specific information, such as queuing paths, and explains any signals and commands referees will give during matches.

3.6.5 Practice Time

At the event, practice field time is offered in the morning until the drivers’ meeting begins. Every effort will be made to equalize practice time for all teams, but it may also be conducted on a first-come, first-served basis. If practice matches are run, these matches may be scored, but the scores do not affect team ranking.

3.6.6 Opening Ceremony

The Opening Ceremony is the official kickoff of the event’s activities for the teams, the fans, and the public. During the Opening Ceremony, a tournament official or the emcee will welcome the teams and the public, introduce dignitaries and other special guests, and introduce the judges and the referees. Then the game will be described (usually with a video) and the national anthems of all the teams’ countries will be played. Immediately after, the Qualification Matches take place.

If your team is in any of the first four matches on the day of your event, volunteers will ask you to line up before the opening ceremonies. Please, make sure your team is on time in case you have an early match.

3.6.7 Qualification Matches

Teams are randomly assigned to qualifying matches and alliances. The qualifying match schedule is available prior to opening ceremonies on the day of the event. This schedule indicates alliance partners and match pairings. It also indicates the alliance’s color (red or blue) and the position in the alliance station (1 or 2) for the drive team. These matches start immediately after the Opening Ceremonies in accordance with the qualification match schedule. The queue volunteer crew works together throughout the day to line up teams for the matches and maintain the schedule. It is very important to pay attention to the match schedule and listen for announcements throughout the day. You need to know when you will compete, find out the number of the ending match before lunch, and find out which match is the last match of the tournament day.

All teams are ranked based on the same number of qualifying matches. In some cases, a team is asked to play a surrogate match which does not count towards their standings during the event. This additional match is denoted on the match schedule or announced to the teams prior to the start of the qualifying matches.

At the conclusion of each match, Qualifying Points (QP) and Ranking Points (RP) are awarded:

- ❖ Teams receive Qualifying Points based on the following:
 - Winning teams of a qualifying match each receive two (2) QP.
 - Losing teams of a qualifying match receive zero (0) QP.
 - If a qualifying match ends in a tie, all four teams receive one (1) QP.
 - If a team is disqualified, they receive zero (0) QP.
- ❖ Ranking Points (RP) are awarded based on the following:
 - The number of ranking points assigned for each match is that of the losing alliance's score. Both Alliances receive the pre-penalized score of the losing alliance as their RP.
 - In the event of a tie, both alliances receive the same number of ranking points, equal to the lowest pre-penalized score. If a team is disqualified, they receive zero (0) RP.
 - If both teams on an alliance are disqualified, the teams on the winning alliance are awarded their own score as their RP for that match.

Teams with non-functioning robots may receive credit for a qualifying match if their robot has passed inspection and at least one member of the drive team is present in the alliance station for the scheduled match. If no member of a team is present in the driver station at the start of a match, that team is declared a "no show" and receives zero (0) QP and zero (0) RP.

At the conclusion of all Qualification Matches, the teams are ranked from first through last on the basis of their total Qualifying Points (QPs). If multiple teams have the same QP total, then teams are ranked on the basis of their total Ranking Points (RPs). If multiple teams have the same RP total as well, then teams are ranked on the basis of their highest match score. If still tied, the next highest match score is used until the tie is broken. In the unlikely event that there is still a tie based on identical match scores, then the teams are ranked by a random electronic draw.

3.6.8 Alliance Selection

The number of teams in the Elimination Matches is based on the number of teams in the tournament. If there are 21 or more teams in the tournament, the Elimination Matches consist of alliances of 3 teams each. If there are 20 teams or less, then the alliances consist of 2 teams each. There are a total of four (4) alliances that will compete in the Elimination Bracket.

The alliance selection process consists of a number of rounds of selections, such that all alliance captains form elimination match alliances consisting of the requisite number of teams. These alliances participate in a ladder-type tournament to determine the event's Winning Alliance. The alliance selection process is as follows:

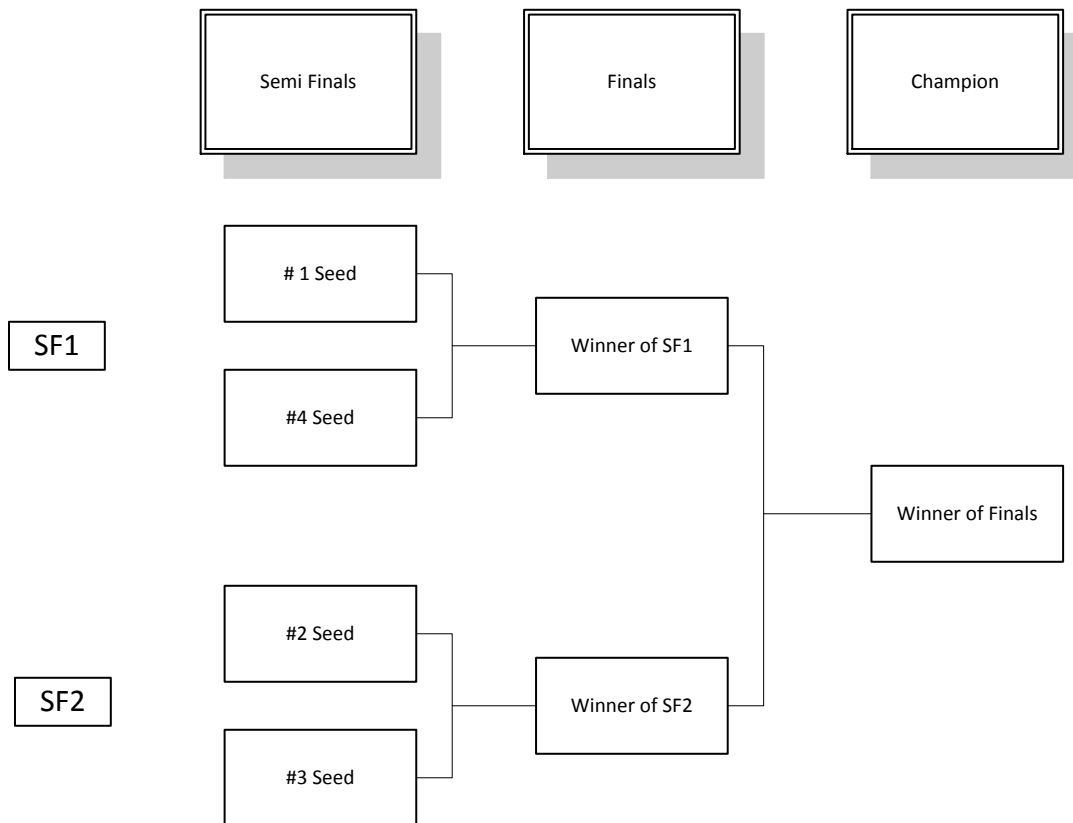
- ❖ Each team chooses one student to act as the team's representative. These representatives will proceed to the competition area at the designated time to represent their teams in the alliance selection. It is recommended that the representative also bring their robot to the competition area as teams making selections may not know team names or numbers, but do know what the robots look like.
- ❖ In order of tournament ranking, the student representative of the highest ranked team not already in an alliance is asked to step forward as the Alliance Captain to invite another available team to join their alliance.
- ❖ A team is available if it is not already part of an alliance, or has not already declined an alliance invitation. If the team accepts, it is moved into that alliance. If a team declines, it CANNOT be invited into another alliance, but it is still available to select their own alliance if the opportunity arises. If a team declines, the alliance captain from the inviting team must then extend an invitation to another team.
- ❖ The process continues until all alliance captains have been designated and chosen one alliance partner.

- ❖ If there are more than 20 teams, the same method is used for each alliance captain's second choice (the third member of the alliance) from highest seed to lowest seed (i.e. 1 -> 2 -> 3 -> 4). Any teams remaining after the lowest seeded captain makes their choice do not compete in the Elimination Matches.

3.6.9 Elimination Matches

The Elimination Matches are very exciting. This is when the alliances determine who is the Champion of the event. The matches are played in a seeded format where the top seed goes up against the 4th seed, and the number 2 seed goes up against the 3rd seed.

In the elimination matches, teams do not get qualifying points; they get a win, loss or tie. Within each bracket of the elimination, matches are played to determine which alliance advances. The advancing alliance is the first one to win two matches. Any tied matches are replayed until one alliance has two wins and advances. An example tournament bracket appears here:



During the elimination matches, two teams from an alliance compete on the playing field. If the alliance has three teams, the team that sits out the first match in an elimination series must play in the second match, with no exceptions. If the alliances play more than two matches in any round, any combination of two alliance robots may be used. The Captain of the Alliance is not required to participate in every match. No special accommodations are made for robots that fail during the Semi Final and Final Rounds. Teams should consider the robustness of the robots when picking alliance partners.

If a team is disqualified during an elimination match, then their entire alliance is disqualified and the match is recorded as a loss. Prior to each elimination match, the alliance captain must let the referee know which two teams are playing in the upcoming match.

3.6.10 Awards and Closing Ceremony

The Awards and Closing Ceremony celebrates the accomplishments of the teams during the season and how they all performed during the event. The ceremony begins as soon as the last match is played, however some awards may be given out earlier in the event day. During the ceremony, teams are recognized for their accomplishments as the awards are handed out. The Winning Alliance teams and the Finalist Alliance teams are also recognized. Finally, the Inspire Award winner is announced.

3.7 Tournament Types

There are several types of events and tournaments that teams and other organizers hold throughout the FTC season and off-season. These are categorized in the following sections.

3.7.1 Local Events

Anyone can host a local event, also known as a scrimmage, to prepare for a Championship or Qualifier, or as an alternative to attending other events. If you choose to create and host a local event, you are responsible for finding a location, organizing the format for the day, and inviting other teams to participate. You may also have to secure the field elements, computers, and other items depending on how you would like the local event to look and feel.

3.7.2 Meets and League Play

If your region has been chosen to participate in a pilot of the Meet format, some of the standard Tournament and Championship guidelines may be modified. For information about the scheduling, structure, advancement and processes that are unique to a pilot event in your region, please contact your local Affiliate Partner.

3.7.3 Qualifying Tournaments

Hosted and managed by FTC Affiliate Partners or Partner-appointed hosts. Qualifying Tournaments follow the same judging and game guidelines and format of Championship Tournaments. Qualifying Tournaments are usually held prior to Championship Tournaments in regions where there are many FTC teams. The number of teams advancing to the state Championship Tournament depends on the capacity of the state Championship Tournament, the number of Qualifying Tournaments, and the number of teams attending the Qualifying Tournament. The Advancement Criteria for moving up to the next level of tournament is detailed in Section 3.8 below.

3.7.4 Championship Tournaments

Hosted and managed by an FTC Affiliate Partner, Championship tournaments abide by certain standards in format, judging, awards, and overall quality. Some Championship tournaments require that teams win at a qualifying tournament or advance through a League in order to advance to the Championship. Championships may include teams from a geographic region, province, state, country, or several countries. Advancement eligibility for the Super-Regional Championship Tournament is the same as moving on from Qualifying Tournaments to the local Championship Tournament and is detailed in Section 3.8 below.

3.7.5 Super-Regional Championship Tournaments

New for the 2013 Season, US Teams have the opportunity to compete in an additional level of Championship Play. Four Super-Regional Championship Events will be held, and hosted by an FTC Affiliate Partner. Championship Super-Regional Championship tournaments abide by certain standards in format, judging, awards, and overall quality. Teams advance from their State or Regional Championship to the Super-Regional Championship using the same advancement criteria described in section 3.8 below. Teams advance from the Super-Regional Championships to the FTC World Championship.

3.8 Advancement Criteria

Teams advance to the next level of competition in the order indicated below according to the number of spots available. The advancement criteria will be applied to teams in North America as follows:

1. Teams advance from a Qualifying Tournament to a Championship Tournament
2. Teams advance from a Championship Tournament to a Super Regional Championship Tournament
3. Teams advance from a Super Regional Championship Tournament to the FTC World Championship

In the event that the team listed has already advanced or there is no team fitting that description (as in 2nd team selected at smaller events), the advancement will continue in order.

1. Qualifier Host Team (NOTE: Assuming that the team competes at one other tournament within the region and has met the criteria set forth by the Affiliate Partner in the agreement. This advancement applies to Qualifying Tournament hosts only, and does NOT apply to host teams of Championship Tournaments).
2. Inspire Award Winner
3. Winning Alliance Captain
4. Inspire Award 2nd place
5. Winning Alliance, 1st team selected
6. Inspire Award 3rd place
7. Winning Alliance, 2nd team selected
8. Think Award Winner
9. Finalist Alliance Captain
10. Connect Award Winner
11. Finalist Alliance, 1st team selected
12. Rockwell Collins Innovate Award Winner
13. Finalist Alliance, 2nd team selected
14. PTC Design Award Winner
15. Highest Ranked Team not previously advanced
16. Motivate Award Winner
17. Highest Ranked Team not previously advanced until all spaces are filled

3.9 Tournament Rules

<T1> Referees have ultimate game play and scoring authority during the competition. Their rulings are final.

- a. The referees may not review any recorded match replays or pictures.
- b. Any questions for the referees must be brought forward by one student driver team member per team within the time period of two (2) matches following the disputed match. Students are required to support their questions by referencing specific rules or posts to the Q&A section of the official FTC Forum. Team members are required to ask their questions in a gracious and respectful manner.
- c. Team members are not allowed onto the playing field for any reason other than to place or retrieve their robots. Inspection of the playing field elements by team members for the express purpose of determining scoring is prohibited. Individuals and teams that violate this rule will be subject to possible team penalties that could include match disqualifications or even removal from the tournament.

<T2> Only three team representatives are permitted in the competition area; two (2) student drivers, and one (1) coach

who are identified by badges designating 'driver' or 'coach.' These badges are interchangeable within a team in between matches. Only student team members wearing a badge designated as 'driver' may drive the robot during the match.

<T3> There are no time outs during the qualifying rounds. The matches must progress according to schedule. If a robot cannot report for a match, at least one member of the team should report to the playing field for the match.

<T4> Teams are guaranteed a minimum of five minutes (5:00) between participating in consecutive matches.

<T5> During the elimination rounds, each alliance will be allotted ONE time out of no more than three minutes (3:00). Time outs must be called at least two minutes (2:00) prior to their next match's starting time. The time out begins at the time their match was going to start.

<T6> All team members and their guests, including coaches, must wear ANSI 87.1 certified safety glasses or prescription glasses with side shields while in the pits or alliance stations during matches.

NOTE: *FIRST* requires all teams to bring and supply, for each competition, ANSI-approved non-shaded safety glasses for its team members, mentors, and guests. For our purposes, amber lenses that allow for enhanced vision are considered tinted, not shaded, and their use is allowed at *FIRST* events. Sunglasses or deeply shaded safety glasses used in our indoor event environment are not acceptable.

<T7> No Team, Team Member, or event attendee is allowed to set up their own Wi-Fi 802.11a/b/g/n/ac (2.4GHz or 5GHz) wireless communication in the venue. Non-allowed wireless communications include, but are not limited to:

- ❖ Cellular Hotspots (e.g. cell phones, tablets, MiFi).
- ❖ Ad-hoc networks.
- ❖ Nintendo DS peer-to-peer.
- ❖ Bluetooth communication with Robots in the Competition area.

No Team, Team Member, or event attendee shall interfere with a Team's wireless communication with their own Robot. This includes illegal interference with the Wi-Fi system for the Competition Fields, Practice Fields, and the Scoring System.

The Penalty for violating rule <T7> is disqualification of the entire Team from the Event and their removal from the venue property. Teams may not appeal the penalty and no refunds will be given for registration fees, pre-paid meals, etc. *FIRST* may conduct a post-Event review and determine if any additional penalties are to be imposed upon the offending Team.

Teams are encouraged to report wireless security vulnerabilities to the Field Tech Advisor at an Event. Teams should always keep in mind *Gracious Professionalism™*, and therefore only report valid and verifiable violations of this rule. After the FTA is alerted of a potential rule violation, he/she will confer with the Head Referee. The FTA and Head Referee will further investigate the potential violation of this rule. The final decision will be made by the Head Referee if rule <T7> has in fact been violated, and to disqualify the offending Team.

3.10 Team Spirit

Competing as a team is fun as well as rewarding. Part of the pleasure and reward of being a team member is the way the team styles itself with team T-shirts, trading buttons, hats, cheers, cheerleaders, and costumes.

3.11 Team Styling

When deciding on a team name or acronym, consider how you can work a theme around it to make your team more fun and recognizable. Refer to Section 8.6 for information about *FIRST* and FTC logo use requirements.

3.12 Banners and Flags

Sponsors provide *FIRST* with banners so we can display them in specified areas as a way of thanking them for their generosity. We encourage teams to bring team flags or sponsor banners, but we ask that you adhere to the following:

- ❖ Do not use banners or flags to section off seating. Saving group seats is not permitted.
- ❖ Hang banners in your pit station only, not on the pit walls.
- ❖ Teams may bring banners to the competition area but please do not hang them there. This area is designated for official *FIRST* sponsors' banners.

3.13 Spectators and Etiquette

Teams are permitted to have 2 student drivers and 1 coach (the Drive Team) at the playing field during their scheduled matches. Spectators are not allowed in the competition area at any time and must remain outside of the designated competition area. Some events may provide media passes for one additional team member to gain access to a designated "media area." Access to this area is only permitted with a media pass and only while the media representative's team is on the playing field. Spectators blocking the sidelines or accessing the media area without a pass will be asked to move. Repeated violations of this rule may cause the associated team to be disqualified.

3.14 Scouting

In the qualifying rounds, the scoring system selects your ally and opponent teams for each match. In elimination rounds, top ranking teams are able to choose their own alliance partners. It is important to select an alliance partner with abilities that complement those of your team. Scouting during the qualifying rounds is a good way to learn the capabilities and limitations of the teams and robots around you.

This information has been provided by the 2007 FRC Chairman's Award winners, FRC Team #365, the Miracle Workerz:

Teams use different methods to record information about other teams – paper, computer, tablets, etc. Use whatever method is most comfortable for your team. Scouting is important to determine how you complement other teams in your alliance and how you match up against your opponents. No matter how you record it, focus on information which will be useful to your team when you meet your alliance partners to discuss strategy.

Some possible areas to gather information include:

- ❖ CAPABILITIES – what can the robot/team do and what does it not do?
- ❖ STRATEGIES – what does the robot / team do during the match? How does the team play the game?
- ❖ PERFORMANCE – how well does the robot / team do what it attempts? What are the robot's strengths and weaknesses?
- ❖ AUTONOMOUS – what does the robot do in autonomous mode? Does the team have multiple program options?

The more data points you can collect on strategies and performance, the better understanding you will have of a given team. Information on a team's capabilities can be obtained by visiting the team in the pit area or watching match play.

4.0 Engineering Notebooks

4.1 Overview

This section describes the requirements for creating the Engineering Notebook, including formatting guidelines, Judges' tips, and the use of various forms of engineering support. It also provides links for sample pages from an award winning FTC Engineering Notebook.

4.2 What is an Engineering Notebook?

One of the goals of *FIRST* and FTC is to recognize the engineering design process and “the journey” that a team makes during the phases of the problem definition, concept design, system-level design, detailed design, test and verification, and production.

Throughout the building of your robot you will come across obstacles, lessons learned, and the need to draw things out on paper. This is where you and your team will use an engineering notebook. These notebooks follow your team from kickoff throughout the competitions. Judges review your engineering notebook to better understand your journey, design, and team.

Note: Refer to the judging criteria in the Awards & Judging Criteria section for more details on how your Engineering Notebook will be judged.

4.3 The Notebook

Teams may choose to record their season with either handwritten, electronic, or online documents. No distinction is made between handwritten and electronic Engineering Notebooks during judging.

Electronic/Online: Teams may choose to use electronic or online programs to create their Engineering Notebook. For the purposes of judging, teams must print out their Engineering Notebooks and place them in a binder, no larger than 1.5”. All pages must be numbered and in order. Only one copy is required per team.

Handwritten: Spiral-bound, laboratory, or documentation notebooks are available through your school or local stationary supply store or you may use the notebook supplied by Rockwell Collins delivered to you in your Kit of Parts. Use the following criteria:

1. Your Team Number and Team Name must be clearly printed on the cover of your Engineering Notebook.
2. Numbered pages are required so that pages cannot be substituted or deleted.
3. Only one Engineering Notebook is required per team.
4. Multiple teams may not share an Engineering Notebook.

4.4 Guidelines/Format

The FTC engineering notebook is a complete documentation of your team’s robot design. This documentation should include sketches, discussions and team meetings, design evolution, processes, obstacles, and each team member’s thoughts throughout the journey for the entire season. A new notebook should be created for each new season. The guidelines are:

1. Document EVERYTHING!!
2. The Engineering Notebook must be divided into multiple sections, including:

- a. An Engineering Section that includes your robot design processes (required)
 - b. A Team Section that includes information about your team, your outreach activities (required)
 - c. Your business plan, strategic plan or sustainability plan (not required)
3. Your Team Number and Team Name must appear on the outside of the Engineering Notebook. Engineering Notebooks will not be considered without this information.
 4. Attach a “summary page” to the front cover of your Engineering notebook. Your summary should give the Judges an overview of the highlights of your season. Your summary page should also include your team number and point the Judges to the pages in your Engineering Notebook that you would most like the Judges to consider.
 5. Engineering Notebooks should be organized enough that an outsider can understand your team and your journey.
 6. Written entries should be in permanent ink – not pencil.
 7. Start the Team Section of your notebook by introducing each team member and mentor with a brief biography of their name, age (or school year), interests, and reasons for joining your FTC team.
 8. Start a fresh page in the Engineering Section at every meeting. The date, and start/stop times should be recorded when starting a new page. Each day should start with two columns:
 - a. Task Column – What is your team doing and discovering?
 - b. Reflections Column – Where your team records thoughts on what is happening and any questions that need to be answered.
 9. Entries should be made by every team member, initialed and dated.
 10. All designs and changes to your robot should be recorded directly into the Engineering Section of your notebook. The inclusion of all details and sketches are preferable. Notes and calculations should be done in your notebook, NOT on loose paper.
 11. In the case of an error, draw a single line through the incorrect data. Do NOT erase or use correction fluid. All corrections should be initialed and dated.
 12. Use both sides of a page. Never leave any white space: “X” out or crosshatch all unused space, and initial and date.
 13. To insert pictures or outside information into your notebook, tape the picture into your notebook and outline with permanent ink, to note that it was there in case it falls out. Put the corresponding page number on that inserted page.
 14. Insert a copy of your robot’s Bill of Materials (BOM) as part of your Engineering Notebook as required by rules in the annual Game Manual.
 15. The Team Section of the Engineering Notebook is also a good place to discuss and show team activities that are done throughout the team’s season.

4.5 Judges’ Tips

- ❖ Every notebook is a work in progress, forever changing and developing. Judges do not want to see a “final” copy notebook if yours is handwritten; they want the real thing complete with misspellings, stains, worn edges and

wrinkled pages. Just remember to keep it real!

- ❖ Pictures along with the bios would serve as a great visual for the judges to get to know each member of your team.
- ❖ A judging panel is always interested to see a unique design or playing strategy. On the other hand, a design without the substance to support its reasoning is not viewed as highly.
- ❖ Pictures or sketches of your robot designs are recommended as part of a thorough documentation.
- ❖ Bring a second copy of the BOM for robot hardware inspection.

4.6 Notebook Examples

Scanned copies of award-winning Engineering Notebook examples are posted on the FTC website. It is strongly encouraged for teams to look over these as great examples of what the judges will be looking for when reading through your Engineering Notebooks.

5.0 The Robot

5.1 Overview

A *FIRST* Tech Challenge Robot is a remotely operated vehicle designed and built by a registered *FIRST* Tech Challenge team to perform specific tasks when competing in the annual game challenge. This section provides rules and requirements for the design and construction of your Robot. Please ensure that you are familiar with the Robot and game rules before beginning Robot design.

5.2 Robot Rules

The intent of the FTC Game Design Committee (GDC) is to create games that can be played with Robots constructed with the TETRIX®, MATRIX®, and/or LEGO® robotics system kits using basic tools and equipment. Anyone that has attended a tournament knows that FTC teams think outside the kit-of-parts to create unique and creative robots. For the 2013-2014 season the GDC has upped the creative potential for robot design by removing many of the legacy restrictions for mechanical/structural items. The GDC hopes that veteran FTC students will enjoy the increased freedom of choice and the resulting simplification of hardware inspection.

5.2.1 General Robot Rules

<RG01> Only ONE Robot will be allowed to compete per registered *FIRST* Tech Challenge team. It is expected that teams will make changes to their Robot throughout the season and at competitions.

- a. It is against the intent of this rule to compete with one Robot while a second is being modified or assembled at a tournament.
- b. It is against the intent of this rule to switch back and forth between multiple Robots at a tournament.

<RG02> Every Robot will be required to pass a full inspection before being cleared to compete. This inspection ensures that all FTC Robot rules and regulations are met. Teams are required to conduct a self-inspection of their robot and submit the completed hardware and software inspection forms at tournament check-in or at another designated place.

Teams must present a bill of materials (BOM) listing any parts used on their robot along with the rule or Q&A post that allows the part. LEGO, TETRIX, and MATRIX parts as well as fasteners do not need to be included in the BOM. It is not necessary to list the quantity of each part in the BOM. A template for a BOM is available for download from www.usfirst.org/ftc/game.

- a. All Robot configurations must be inspected before being used in competition.
- b. If significant changes are made to a Robot after it has passed the initial inspection, it must be re- inspected before it will be allowed to compete.
- c. Referees or inspectors may request the re-inspection of a Robot. The Robot is not allowed to participate in a match until it passes re-inspection. Refusal to submit to re-inspection will result in disqualification of the team.
- d. Appendices 1 and 2 of this manual contains a copy of the robot inspection form and provides additional information about the inspection process.

<RG03> The following types of mechanisms and components are not allowed:

- a. Those that could potentially damage Playing Field components.
- b. Those that could potentially damage or flip other competing Robots.
- c. Those that contain hazardous materials (e.g. mercury switches, or lead substrates).
- d. Those that pose an unnecessary risk of entanglement.
- e. Those that contain sharp edges or corners.

<RG04> The maximum size of the Robot for starting a Qualifying or Elimination Match is 18 inches (45.72cm) wide by 18 inches (45.72cm) long by 18 inches (45.72cm) high. The Robot Sizing Box will be used as the official gauge in determining conformance to this rule. To pass inspection a robot must fit within the box without exerting force on the sides or top of the box. Robots may expand beyond the starting size constraint after the start of the match.

The Robot must be self-supporting while in the Robot Sizing Box by either:

- a. a mechanical means with the Robot in a power-OFF condition. Any restraints used to maintain starting size (i.e. zip ties, rubber bands, string, etc.) MUST remain attached to the Robot for the duration of the match.
- b. a Robot Initialization Routine in the Autonomous mode program that may pre-position the servo motors, with the Robot in a power-ON condition, to the desired position by means of a single instruction to the HiTechnic Servo controller for each servo motor effected. If the Robot Initialization Routine does move the servos when a program is executed, there must be an indicator on the Robot of this fact. A warning label placed near the robot's main power switch is required. Affix the image below to your robot if servos are commanded to move during the initialization routine:



<RG05> The Robot main power switch(es) MUST be mounted/positioned to be readily accessible and visible to competition personnel. A Main Robot Power label must be placed near the main power switch(es) of the robot. Please print this page and affix the image (below) to your robot.



**MAIN ROBOT
POWER**

<RG06> Batteries MUST be securely attached to the robot.

<RG07> The NXT controller and Samantha Wi-Fi Communication Module MUST be accessible and visible by competition personnel.

- a. The NXT battery MUST be easily removable with minimal disassembly of the Robot.
- b. The USB ports and buttons on the NXT and Samantha Wi-Fi Communication Module MUST be easily accessible.
- c. The NXT Controller liquid crystal display and Samantha Wi-Fi Communication Module LEDs MUST be readily visible.
- d. The NXT Controller and Samantha Wi-Fi Communication Module shall be mounted such that they are protected from contact with the Playing Field elements or other Robots. These and other electrical components (batteries, motor and servo controllers, switches, etc.) make poor bumpers and are unlikely to survive the rigors of game play when attached in a Robot-to-Robot contact area.

<RG08> Robots MUST include a mounting device to securely hold one tournament supplied FTC Robot Alliance Identification Flag throughout an entire match. Because of the need to clearly identify a Robot's Alliance, the flag MUST be mounted at the TOP of the Robot and be clearly visible throughout the match. Flag posts are typically a soda straw with dimensions that are close to 0.25" (0.635cm) OD x 0.20" (0.5cm) ID x 8.250" (20.955cm) length with a triangular flag 4.0" (10.16cm) high x 6.0" (15.24cm) wide. These may vary from event to event. Mounting devices that damage the flag post are not acceptable.

<RG09> Robots MUST prominently display their team number (numerals only, e.g. "1234").

- a. The judges, referees, and announcers must be able to easily identify Robots by team number.
- b. Team number must be visible from at least two sides of the Robot (180 degrees apart).
- c. The numerals must each be at least three inches high, at least in 0.5" (1.27cm) stroke width, and in a contrasting color from their background.
- d. Team numbers must be robust enough to withstand the rigors of match play.
- e. Team numbers and their mounting surface are not required to be made of specifically allowed material so long as the materials do not affect the function or performance of the Robot. Examples of recommended number materials include:
 - i. Self-adhesive numbers (i.e. mailbox, or vinyl numbers)
 - ii. Ink jet or laser printed numbers on laminated paper or adhesive-backed paper.

<RG10> Energy used by *FIRST* Tech Challenge Robots, (i.e., stored at the start of a MATCH), shall come only from the following sources:

- a. Electrical energy derived from the onboard TETRIX or MATRIX battery pack, HiTechnic 9-volt Battery Box for the sensor multiplexer, MATRIX Battery Box for powering the Samantha unit (MATRIX robots only), the battery for the visible LEDs, and the NXT battery.
- b. Compressed air stored in the LEGO pneumatic system.
- c. A change in the position of the Robot center of gravity.

- d. Storage achieved by deformation of Robot parts. Teams must be very careful when incorporating spring-like mechanisms or other items to store energy on their Robot by means of part or material deformation. A Robot may be rejected at inspection if, in the judgment of the inspector, such items are unsafe.

<RG11> Game elements launched by Robots should not have a velocity greater than that required to reach a maximum of four (4) feet (1.2 meters) above the playing field surface, nor travel a horizontal distance greater than ten (10) feet (3 meters) from the point that the game element ends contact with the robot.

5.2.2 Robot Parts and Materials Rules

<R01> All LEGO parts are allowed except for the following:

- a. Any DUPLO parts
- b. LEGO MINDSTORMS EV3.

<R02> All TETRIX parts are allowed except for the following:

- a. R/C Controller (Product Id W34243 or W36117)
- b. R/C Receiver (Product Id W35496)
- c. Infrared Electronic Ball (Product Id W991458)
- d. DC Motor Speed Controller (Product Id W34244)
- e. Wireless Camera Kit (Product Id W37291)
- f. Autonomous Mounting Deck (W37799)
- g. R/C Mounting Deck (W37663)
- h. Battery Holder (W39136).

<R03> All MATRIX parts are allowed.

<R04> In addition to the TETRIX, LEGO, and/or MATRIX components, teams may use additional raw materials to construct their robots. A Raw Material is defined as a material that is supplied in a simple, extruded form with little or no post forming or machining that is done by the vendor. The following rules pertain to the use of Raw Materials:

- a. Raw materials may be used in any dimension and quantity. Teams may use these raw materials to make any type of finished part.
- b. A Raw material can be any type of commonly available material including steel, aluminum, plastic (of any kind), fiberglass, carbon fiber, stone, wood (including paper, plywood, etc.). Also included are castable materials such as polymer resins, rubber, cement, etc.
- c. To be legal a Raw Material must be readily available to the majority of teams from standard distributors (e.g. McMaster-Carr, Home Depot, Grainger, etc.). Materials that are found in only one region or can only be obtained from a team's sponsor are not allowed.
- d. Materials in the form of angle, channel, tubing, sheet, film, blocks, etc. are allowed but these same shapes with post machined features (holes, slots, etc.) are considered to be Commercial Off The Shelf (COTS) and are constrained by Rule <R05>.
- e. Due to health and safety concerns, animal based materials are not allowed.
- f. Liquid materials are not allowed.

<R05> The intent of <R05> is to augment the TETRIX, LEGO and MATRIX robot system kits with a few select

assemblies/mechanisms that might be useful for this year's game challenge. For the purpose of this rule, Commercial Off The Shelf (COTS) assemblies are considered to be component parts that have been fitted together or parts that have been pre-formed or pre-fabricated by a supplier to perform a given function. In general, COTS are not permitted with the following exceptions:

- a. Linear Slides
- b. Non-motorized Turntables and Lazy Susans.
- c. Lead Screws and threaded rod plus compatible nuts.
- d. Servo blocks (ONLY ServoCity Part # SB608SH and SB609SH, no other servo blocks are allowed), shaft adaptors, servo arms, ball links, shaft clamps.
- e. #25 or #35 chain with associated links.
- f. Timing belts of any size and pitch.
- g. Gears of any size and pitch, including non-circular gears such as rack, worm, bevel, etc.
- h. Sprockets of any size and pitch.
- i. Pulleys including sheaves, timing belt, etc.
- j. Springs of any type and material (coil, extension, compression, leaf, etc.) that are used in a safe manner.
- k. Fasteners of any size, including nuts, bolts, screws, shoulder screws, washers, spacers, shaft collars, shaft couplers, rivets, Velcro, etc.
- l. Bearings of any type and material. Including bushings, roller bearings, etc.
- m. PVC, CPVC, PEX piping and fittings.
- n. Extruded or T-slot aluminum construction material along with all compatible brackets and fittings (i.e. 80-20, Macron Dynamics, etc.).
- o. Wheels of any type up to 4" diameter (as measured at the outer surface of the tread). Wheels that have exposed features likely to cause damage to field and/or game elements are not allowed. Wheels are considered to be the total of the rim (the plastic or other material on the inside), the tire (the rubber or other material on the outside), and the manufacturer provided wheel hub used to mount the wheel to an axle. Individual components of a legal wheel assembly can be used on the robot (as long as wheel and hub are 4" diameter or less).
- p. Allowable COTS parts may be acquired from any source and in any quantity.

<R06> In addition to the raw materials listed in <R04>, teams may use the following materials in any size, quantity and for any purpose:

- a. Rope, cord, cable, monofilament, etc. These can be made from natural (cotton, wool, etc.), polymers (nylon, polyester, etc.), or metal materials.
- b. Rubber bands.
- c. Surgical or Latex Tubing.
- d. Non-metallic cable ties (also known as Zip Ties).
- e. Non-Slip Pad (e.g. McMaster-Carr Part #69275T54 or Home Depot SKU #134555). Packaging material must list the product as Non-Slip Pad.

- f. Adhesive backed tape of any type.
- g. Glue, cement, adhesives.

<R07> Welding, brazing, and soldering are legal methods for assembling a robot.

<R08> Robot electronics are constrained to the following:

- a. Exactly one (1) LEGO MINDSTORMS NXT Controller MUST be used. Additional microprocessors are not permitted unless they are an integral part of an allowed part, or attached to the HiTechnic SuperPro Prototype or the NXT Prototype Boards, or are purely decorative in function. The EV3 Controller is not approved for use in FTC Competitions.
- b. The NXT controller must be powered either by the NXT rechargeable AC battery (W979798), NXT DC Battery (W979639), or six (6) AA batteries.
- c. Battery Packs
 - i. Exactly one (1) TETRIX rechargeable battery pack used to power HiTechnic DC Motor Controllers, HiTechnic Servo Controllers, the Samantha Wi-Fi module, and visible light LEDs.
 - Or
 - ii. Not more than two (2) MATRIX battery packs used to power MATRIX Motor and Servo Controllers. One battery pack is to be used per Motor and Servo Controller. Battery Packs must power independent electrical circuits; multiple battery packs may not be connected together in parallel or serial.
- d. Exactly one (1) MATRIX Battery Box to power the Samantha Wi-Fi module for robots using the MATRIX electronics.
- e. Exactly one (1) power switch that turns the robot on or off per Battery Pack. The power switch MUST be installed between the battery and all electronics that it powers. Matrix Battery Pack Power Switches must be placed side by side on the robot.
- f. A robot is constructed with either TETRIX or MATRIX motor and servo controllers, not both. Any quantity of TETRIX (HiTechnic) or MATRIX Motor and Servo Controllers are permitted provided that the quantity doesn't exceed the technical specifications for these devices, the NXT, and the software. Motor controller outputs may only be used to directly control DC motors. Servo controller outputs may only be used to directly control servos.
- g. A maximum total of eight (8) TETRIX or eight (8) MATRIX DC motors are allowed and must be controlled by a compatible TETRIX or MATRIX controller. A robot is constructed with either TETRIX or MATRIX DC motors, not both.
- h. A maximum of twelve (12) servos are allowed, provided that they are compatible with and controlled by TETRIX (HiTechnic) or MATRIX controllers. For TETRIX (HiTechnic) Servo Controllers:
 - i. Any combination of the following servos is allowed per servo controller: 180 Degree HiTEC HS-475HB and HS-485HB, Continuous Rotation W39177 and HiTEC HSR-1425CR, hobby servos "standard" size and smaller (i.e. standard, mini, micro) with rated stall current of 800mA or less.
 - ii. Quarter-scale HiTEC HS-755HB and HiTEC 785HB servos may be used. If HS-755HB or HS-785HB servos are used, the number of allowed servos per TETRIX (HiTechnic) Servo Controller is limited as follows:
 - No more than two (2) quarter-scale servos may be connected to a single Servo Controller.
 - If two (2) quarter-scale servos are attached a controller, only one (1) additional servo of the type

listed in <R08>h(i) may be used.

- If only one quarter-scale servo is attached a controller, no more than four (4) additional servos of the type listed in <R08>h(i) may be used.
- i. LEGO approved/certified motors may be used with the following constraints (per NXT motor port):
 - i. One (1) NXT Interactive Servo Motor (LEGO Part # W979842)
 - ii. One (1) XL Power Function Motor (LEGO Part # W778882)
 - iii. Two (2) E Power Function Motors (LEGO Part # W979670)
 - iv. Two (2) M Power Function Motors (LEGO Part # W978883)
 - v. One (1) E Motor and one (1) M Motor
 - vi. Any number of NXT conversion cables to connect the Power Function Motors with the NXT (LEGO Part #s W770323, W778886, or W778871) are allowed.
 - vii. Power Function Battery Packs (LEGO Part #s W778881 or W778878) are NOT allowed.
 - j. Exactly one (1) Samantha Wi-Fi Communication Module with USB A-B cable (and optional pigtail) to go from the Samantha module to the NXT (24"/60.96 cm or shorter is recommended) must be used. USB cables with integral ferrite chokes (e.g. Tripp Lite U023-003) are allowed. Separate ferrite choke cores that snap onto USB cables (e.g. RadioShack # 273-105) are also allowed. No other wireless communication is permitted during match play.
 - k. Only LEGO Approved NXT and RCX sensors (as indicated by the LEGO certified hardware label), and HiTechnic NXT compatible sensors are allowed to be directly connected to the NXT, the HiTechnic Sensor Multiplexer, and the HiTechnic Touch Sensor Multiplexer.
 - l. The HiTechnic NXT Touch Sensor Multiplexer (MUX) and NXT Sensor Multiplexer (MUX) are allowed.
 - m. The HiTechnic 9-volt Battery Box that is sold as part of the NXT Sensor Multiplexer set may be used in conjunction with each NXT Multiplexer (i.e. one Battery Box per Sensor Multiplexer). It may be used only in conjunction with the NXT Sensor Multiplexer(s) to provide power for the MUX.
 - n. HiTechnic SuperPro Prototype Board, and the NXT Prototype Boards (both solderable and solderless) are allowed with the following constraints:
 - i. All power used in the circuits connected to the Prototype Board must be derived from the power connections provided within the board. No batteries or external power sources are allowed.
 - ii. Circuits may connect only to the named connections provided by the Prototype Board (i.e. A4-A0, B5-B0, 3V, 4V, 9V, 5V, GND) or SuperPro Prototype Board (i.e., A3-A0, B7-B0, S3-S0, O1-O0, WR, RD, 3V, 9V, 5V, GND)
 - iii. Communication to the NXT Controller may only occur through the included NXT connector.
 - iv. Any compatible sensor may be connected to the Prototype Board, provided that no other rules are violated. Sensors may be distributed throughout the Robot; they do not need to be physically attached to the Prototype Board.
 - v. Additional circuit boards may be connected to the Prototype Board as needed.
 - vi. The processor included in the Prototype Board may not be reprogrammed.
 - vii. Circuits included as part of the HiTechnic Prototype Board may not cause interference with any Robot

on the playing field, any part of the field management system or any game element.

- viii. Non-LEGO certified sensors may only be attached to an NXT Prototype Sensor Board or a SuperPro Prototype Board.
- o. LEGO-Approved NXT extension cables are allowed. Approved cables are currently only available from LEGO and HiTechnic. Custom-made NXT cables are not permitted.
- p. LEGO-Approved NXT Conversion Cables to connect RCX sensors or Power Function Motors to the NXT (LEGO Part #s W770323, W778886, or W778871) are allowed.
- q. Anderson PowerPole, and similar crimp or quick connect style connectors for joining electrical wires are allowed. Power distribution splitters may also be used (and are strongly recommended) to make wiring easier. All connectors/distribution splitters should be appropriately insulated.
- r. Non-NXT power, motor control, servo, and encoder wires and their connectors may be extended, custom made, or COTS subject to the following constraints:
 - i. Battery wires are 16 AWG or larger
 - ii. Samantha power wires are 18 AWG or larger
 - iii. Motor control wires are 22 AWG or larger
 - iv. PWM wires are 20 AWG or 22 AWG
 - v. Power and motor control wires are strongly recommended to use consistent color coding with different colors used for the Positive (red, white, brown, or black with a stripe are recommended) and Negative/Common (black or blue are recommended) wires.
- s. Visible light LEDs with their connected electronic circuits are allowed. Power for the LEDs may be provided by the main robot battery pack (TETRIX or MATRIX) or by no more than one (1) battery of any type not to exceed 9 volts. LEDs used as visual cues must be controlled via connections to a HiTechnic SuperPro Prototype Board or the NXT Prototype Board.
- t. Wire and cable management products of any type are permitted (e.g. cable ties, cord clips, sleeving, etc.).
- u. Wire insulation materials of any type are permitted when used to insulate electrical wires or secure motor control wires to motors (e.g. electrical tape, heat shrink, etc.).
- v. Electrical components that are not specifically allowed by the rules (i.e. sensors, batteries, microprocessors, etc.) are not permitted. Note that Microprocessors may be used only when connected thru the HiTechnic SuperPro Prototype Board or the NXT Prototype Board.
- w. Motors, sensors, controllers, and any other electrical components may not be altered from their original state in ANY way unless specifically allowed by the Robot rules.
- x. Also, the connectors on the TETRIX and MATRIX battery packs may be replaced or augmented with any compatible connector described in <R08.q> above.
- y. Video recording devices (GoPro or similar) are allowed providing they are used only for non-functional post match entertainment. Cameras must not have built-in wireless capability.

<R09> LEGO pneumatic elements are allowed. Teams may not modify LEGO pneumatic elements to attempt to change the pressure limits of the elements.

<R10> Electrical solder is allowed.

<R11> Any type of COTS lubricant is allowed, provided that it doesn't contaminate the playing field, game elements, other Robots, etc.

<R12> Team designed 3D printed parts are allowed.

<R13> Robots may contain decorations provided that that they are non-functional; do not affect how the robot interacts with the playing field, field elements, or other robots; do not require external power except as specified in rule <R08.s>; do not affect the outcome of the match; are not hazardous to themselves or other teams; and are in the spirit of Gracious Professionalism. A simple test of decorative vs. functional; if the items in question were turned off and/or removed from the robot, there would be no change in the capabilities of the robot, the team, or the alliance, nor any change in the outcome of the match.

5.2.3 Robot Software Rules

<RS01> The Robot must be designed to be controlled by no more than two (2) Logitech Gamepads. Official FTC tournaments will provide either the Logitech DualAction or Logitech F310 gamepads in any combination for the competition playing fields.

<RS02> Each team MUST "name" their NXT with their official FTC Team number (e.g. "1234"). Spare NXTs should be named with the team number followed by a hyphen then a letter designation beginning with "B" (e.g. "1234-B", "1234-C"). Should a spare NXT be "loaned" to another team, the receiving team should rename the NXT with their corresponding team number along with the hyphenated letter designation showing the Field Control System that it is a spare.

<RS03> Programming for the *FIRST* Tech Challenge must be done with an approved programming language, using MANDATORY FTC Competition Templates, and corresponding firmware. Approved programming languages are:

- a. ROBOTC version 3.0 or later (firmware version 9.0 or later)
- b. LabVIEW for LEGO MINDSTORMS 2012 (LVLIM 2012) (NXT Firmware version 1.31 or later)

Templates for all programming choices are available at www.usfirst.org/roboticsprograms/ftc/programmingresources.

If updates are announced later in the season, teams must update to the latest version prior to time of competition.

<RS04> The "Samostat" program MUST be installed on the NXT. Once installed, the team does not have to install Samostat again unless a new version of the Samostat code is released, the programming environment is updated, or firmware is re-installed on the NXT.

<RS05> The "Program Chooser" program MUST be installed on the NXT. The Program Chooser enables teams to select the program started by the FCS for the Driver-Controlled portion of the match without having to connect the NXT to a computer. Once installed, the team does not have to install it again unless firmware is re-installed on the NXT, a new version of the Program Chooser code is released, or the programming environment is updated.

<RS06> The NXT MINDSTORMS Controller Sleep Timer must be set to NEVER.

<RS07> Robots will connect to the tournament supplied Field Control System (FCS) located at each field.

Teams must demonstrate that their Robot switches between Autonomous mode and Driver-Controlled mode correctly using the latest version of the FCS. This is done during Software Inspection.

<RS08> Immediately prior to the start of the Autonomous Period and during the pause between then end of the

Autonomous and the start of the Driver Controlled periods, robots shall be motionless, with the exception of initialization of positioning for servos. Violations subject the robot to random repositioning by the head referee. Repeated violations may lead to disqualification of the robot.

6.0 Robot Inspection

6.1 Overview

This section describes *Robot* Inspection for the *FIRST* Tech Challenge 2013-2014 competition. It also lists the inspection definitions and inspection rules.

6.2 Description

The FTC *Robot* will be required to pass hardware and software inspections before being cleared to compete. These inspections will ensure that all FTC *Robot* rules and regulations are met. Initial inspections will take place during team check-in/practice time. The official FTC “Robot Inspection Checklists” are located in the appendix. **Teams are required to conduct a self-inspection of their robot and submit the completed hardware and software inspection forms at tournament check-in.**

6.3 Definitions

Robot - An operator controlled and/or autonomous programmed vehicle designed and built by a *FIRST* Tech Challenge team to perform specific tasks while competing in the annual game challenge. The Robot may only be constructed from materials and components outlined in Section 5.

Robot Initialization Routine – A set of programming instructions inserted immediately prior to the match control loop of the Autonomous or Driver-Controlled programs that serves to ready the *Robot* for a match.

Robot Sizing Box – A sturdily constructed cube with the interior dimensions; 18 inch (45.72cm) by 18 inch (45.72cm) by 18 inch (45.72cm) that has one open side with an interior opening size of 18 inch (45.72cm) by 18 inch (45.72cm). The Sizing Box is used for Robot Inspection as outlined in Section 2.4.

6.4 Inspection Rules

<I1> FTC teams must submit their *Robot* for inspection prior to participating in practice rounds. At the discretion of the FTC Lead Inspector, the *Robot* may be allowed to participate in practice rounds before passing inspection.

<I2> The team’s *Robot* must pass all inspections before participating in Qualification Rounds. Noncompliance with any *Robot* design, construction rule, or programming requirements may result in disqualification of the *Robot* at an FTC event.

<I3> The maximum size of the *Robot* for starting a Qualifying or Elimination Match is 18 inches (45.72cm) wide by 18 inches (45.72cm) long by 18 inches (45.72cm) high. The *Robot Sizing Box* will be used as the official gauge in determining conformance to this rule. To pass inspection a robot must fit within the box without exerting force on the sides or top of the box. The *Robot* must be self-supporting while in the *Robot Sizing Box* either:

- a. by mechanical means with the *Robot* in a power-OFF condition, or
- b. by a *Robot Initialization Routine* in the Autonomous mode program that may pre-position the servo motors, with the *Robot* in a power-ON condition, to the desired position by means of a single instruction to the HiTechnic

Servo controller for each servo motor effected. The label shown in rule <RG04> must be affixed to the robot if servos move during the *Robot Initialization Routine*.

<I4> The team is required to request a re-inspection of their *Robot* by an Inspector when a modification to improve performance or reliability of their *Robot* has been made.

<I5> It is the FTC Inspector's responsibility to evaluate *Robots* to insure each *Robot* has been designed to operate and function safely. Section 5 and Game Manual Part 2, Section 1.5.1 specify the safety rules and limitations that apply to the design and construction of all *Robots*.

<I6> *Robot* inspection is a Pass / Fail process. A *Robot* has passed inspection when ALL requirements listed on the official FTC "*Robot Inspection Sheets*" have been successfully met and recorded as passed by an FTC Inspector.

7.0 Judging & Award Criteria

7.1 Overview

This chapter provides a complete description of all of the FTC Awards; the judging process, criteria and philosophy that teams need to be aware of in preparation for participating at FTC Tournaments.

Teams have spent a significant amount of time designing, building, programming their robot, and learning what it takes to be a part of a team. For many FTC teams, the event is the reward for all their hard work throughout the season. While there are several types of events, they all offer a fun and exciting way for teams to demonstrate the result of their efforts.

The judged awards represent another positive way we recognize teams who embody important values like teamwork, creativity, innovation, and the value of the engineering design process. These judging guidelines are a part of the road map to success.

7.2 FTC Award Eligibility

To ensure fairness to all teams and to provide equal opportunity for all teams to win an award at an FTC Championship tournament, teams are only eligible to win an award at the first three Championship tournaments that they attend. Those teams who compete in more than three Championship tournaments do so for the purpose of being involved in the fun and excitement of the tournament and not with the intention of winning awards or advancing to the next tournament level.

Teams are allowed to win the Inspire Award only once during each tournament level (Qualifying, Championship, and Super-Regional) in their region. Once a team wins the Inspire Award at a Qualifying tournament in their region, they are not eligible for consideration for the Inspire Award and are only eligible to win the other judged or alliance awards at subsequent Qualifying tournaments in their region. The same restriction applies to teams attending multiple Championship and Super-Regional tournaments.

7.3 FTC Award Categories

7.3.1 FTC Inspire Award

This formally judged award is given to the team that truly embodied the 'challenge' of the FTC program. The team that receives this award is chosen by the judges as having best represented a 'role-model' FTC Team. This team is a top

contender for all other judging categories and is a strong competitor on the field. The Inspire Award Winner is an inspiration to other teams, acting with Gracious Professionalism™ both on and off the playing field. This team is able to communicate their experiences, enthusiasm and knowledge to other teams, sponsors, and the Judges. Working as a unit, this team will have demonstrated success in accomplishing the task of creating a working and competitive robot.

In past seasons, the winner of the Inspire Award at each tournament level has received an automatic invitation to the next tournament level. Once a team has won an Inspire Award at a Championship, they are no longer eligible to win the Inspire Award at additional championship tournaments they may attend. Similarly, once a team wins an Inspire Award at a Qualifying tournament, they are no longer eligible to win the Inspire Award at subsequent Qualification tournaments within the same region.

Guidelines for the Inspire Award:

- ❖ Team must demonstrate respect and Gracious Professionalism both for team members and fellow teams
- ❖ Team is a strong contender for all Judged awards. The Inspire Award is based on the guidelines for all of the Judged Awards
- ❖ Engineering Notebook must be submitted, and must include an Engineering Section, a Team Section and a Business or Strategic Plan. The entire Engineering Notebook must impress the judges
- ❖ Team demonstrates and documents their work in their community spreading awareness of the team, *FIRST*, and FTC within the community
- ❖ Team displays good communication and teamwork skills within the team as well as with their alliance partners
- ❖ Team communicates clearly about their robot design and strategy to the judges
- ❖ Team presents themselves well in the judges' interview
- ❖ Robot and team effectively competes in the game challenge and impresses the judges
- ❖ Team and robot consistently perform well during matches

7.3.2 Rockwell Collins Innovate Award

The Rockwell Collins Innovate Award celebrates a team that not only thinks outside the box, but also has the ingenuity and inventiveness to make their designs come to life. This judged award is given to the team that has the most innovative and creative robot design solution to any or all specific field elements or components in the FTC game. Elements of this award include elegant design, robustness, and 'out of the box' thinking related to design. This award may address the design of the whole robot, or of a sub-assembly attached to the robot. The creative component must work consistently, but a robot does not have to work all the time during matches to be considered for this award. The team's Engineering Notebook should be marked with journal entries to show the design of the component(s) and the team's robot in order to be eligible for this award, and entries should describe succinctly how the team arrived at that solution.

Guidelines for the Rockwell Collins Innovate Award:

- ❖ Team demonstrates respect and Gracious Professionalism to all
- ❖ Robot or robot sub-assembly must be elegant and unique in its design
- ❖ Creative component must work reliably
- ❖ Team must submit an Engineering Notebook with an Engineering Section
- ❖ Robot is stable, robust and controllable
- ❖ Robot design is efficient and consistent with team plan and strategy

7.3.3 PTC Design Award

This judged award recognizes design elements of the robot that are both functional and aesthetic. All successful robots have innovative design aspects; however, the PTC Design Award is presented to teams that incorporate industrial design elements into their solution. These design elements could simplify the robot's appearance by giving it a clean look, be decorative in nature, or otherwise express the creativity of the team. The winning design should not compromise the practical operation of the robots but complement its purpose. This award is sponsored by Parametric Technology Corporation (PTC), developers of the CAD tools, Creo and Mathcad. PTC gives licenses to the FTC student teams for these software products to help them with their designs. Use of these tools is not required to be eligible, however, teams that use them in their design are given extra consideration for this award.

Guidelines for the PTC Design Award:

- ❖ Team demonstrates respect and Gracious Professionalism to all
- ❖ Team must submit an Engineering Notebook with an Engineering Section that includes detailed robot design drawings
- ❖ Robot differentiates itself from others
- ❖ Design is both aesthetic and functional
- ❖ Basis for the design is well considered (i.e. inspiration, function, etc.)

7.3.4 Connect Award

This judged award is given to the team that most connected with their local community and the engineering community. A true *FIRST* team is more than a sum of its parts, and recognizes that its schools and communities play an essential part to their success. The recipient of this award is recognized for helping the community understand *FIRST*, the FTC, and the team itself. The team that wins this award is aggressively seeking engineers and exploring the opportunities available in the world of engineering, science and technology. In addition, this team has a clear Business or Strategic Plan and has identified steps to achieve their goals.

Guidelines for the Connect Award:

- ❖ Team demonstrates respect and Gracious Professionalism to all
- ❖ An Engineering Notebook must be submitted and must include a Business or Strategic plan.
- ❖ Team provides clear examples of outreach to community
- ❖ Team has worked to develop an in-person or a virtual connection with the engineering, science or technology community
- ❖ Team has a business or strategic plan that identifies their future goals and the steps they will take to reach those goals. The plan could include fundraising goals, sustainability goals, timelines, outreach and community service goals.

7.3.5 Motivate Award

This judged award celebrates the team that exemplifies the essence of the FTC competition through team building, team spirit and enthusiasm. They celebrate their team, their individuality and their spirit through costumes and fun outfits, a team cheer and their outstanding spirit. This team has also made a collective effort to make *FIRST* known throughout their school and community.

Guidelines for the Motivate Award:

- ❖ Team demonstrates respect and Gracious Professionalism to all
- ❖ Team functions as a cohesive unit to discover the goals of the program
- ❖ Team can articulate the journey of becoming a team of individuals with different roles
- ❖ Team has formed and can articulate internal processes to assign roles and communicate between team members
- ❖ Team attitude of celebration and spirit is consistent throughout the team and the competition
- ❖ Team is enthusiastic
- ❖ Team functions well as a unit
- ❖ Team enthusiasm is evident in community outreach

7.3.6 Think Award

This judged award is given to the team that best reflects the “journey” the team took as they experienced the engineering design process during the build season. The engineering section of the notebook is the key reference for judges to help identify the most deserving team. The team’s engineering notebook should focus on the design and build stage of the team’s robot. Journal entries of interest to judges for this award will include those describing the underlying science and mathematics of the robot design and game strategies, the designs, re-designs, successes, and those ‘interesting moments’ when things weren’t going as planned. A team is not a candidate for this award if they have not completed the Engineering Section of the Engineering Notebook.

Guidelines for the Think Award:

- ❖ Team demonstrates respect and Gracious Professionalism to all
- ❖ Team must submit an engineering notebook with an Engineering Section Team notebook must be clearly identified with the Team # and Team Name
- ❖ Engineering notebook must demonstrate that the team has a clear understanding of the engineering design process, with pictures or drawings and details documenting all stages of robot design
- ❖ Engineering notebook must be organized and follow the formatting guidelines provided by *FIRST* and include a Summary Page
- ❖ Teams must tab/flag 6 to 8 pages of the Engineering Section to support entries on the summary page.
- ❖ It is acceptable to include designs/ideas that are adapted from an outside source, providing that this is noted and credit is cited to the original source
- ❖ Supporting drawings and diagrams must be included in the correct chronological order, not in a separate section.

Note: Teams should review the engineering notebook section of this manual for a complete description and format specifications.

7.3.7 Control Award (Optional Pilot)

The Control Award celebrates a team that uses sensors and software to enhance the robot’s functionality on the field. This award is given to the team that demonstrates innovative thinking in the control system to solve game challenges such as autonomous operation, enhancing mechanical systems with intelligent control, or using sensors to achieve better results on the field. The control component should work consistently on the field. The team’s Engineering Notebook should contain details about the implementation of the software, sensors, and mechanical control. Please check with your local Affiliate Partner to find out if this award will be offered in your region.

Guidelines for the Control Award:

- ❖ Team demonstrates respect and Gracious Professionalism to all
- ❖ Team must submit an Engineering Notebook with an Engineering Section
- ❖ Control Components must be documented in the Engineering Notebook
- ❖ Control Components must enhance the functionality of the robot on the field
- ❖ Control Components must work reliably
- ❖ Teams are encouraged to demonstrate control components to the Judges
- ❖ Advanced software techniques and algorithms are encouraged
- ❖ Prototyped sensors and custom hardware are encouraged

7.3.8 Promote Award (Optional)

This judged award is optional and may not be given at all tournaments. Please contact your tournament organizer to determine if it will be given at an event you attend.

The Promote Award is given to the team that is most successful in creating a compelling video message for the public designed to change our culture and celebrate science, technology, engineering and math.

Guidelines for the Promote Award:

- ❖ Team must present a thoughtful and high-quality video which appeals to the general public.
- ❖ Strong production value is important, but the message and impact of the video are of greater weight for the judges.
- ❖ Creativity in interpreting the annually assigned theme is desired.
- ❖ Submissions for this award will be considered for the Inspire Award but are not required.
- ❖ Team must have rights to any music used in the video.

Winning videos will be submitted to *FIRST* and used to promote the higher values of the FTC. Teams may win the Promote Award only once at a Championship level event and only once at a qualifying level event.

Team must submit a one-minute long public service announcement (PSA) video one full week prior to the event to be eligible for this award. Additional submissions are welcome but will not be eligible for awards. The submission process for this award may vary by tournament. Please check with your tournament's organizer for details.

PSA Subject for 2013-2014 Season

- ❖ Create a one-minute PSA video that begins with the following sentence: "Leadership is"

7.3.9 Compass Award (Optional)

An FTC team is about more than building robots, and competing at tournaments, it is a journey to a destination through trial and error, success and failure, with challenging new technology and obstacles to navigate where no road maps are provided. How does a team find their way?

The Compass Award recognizes an adult Coach or Mentor who has provided outstanding guidance and support for a team throughout the year. The winner of the Compass Award will be determined from candidates nominated by FTC team members, via a 40-60 second video submission, highlighting how their Mentor has helped them become a champion team. We want to hear what sets the Mentor apart.

Guidelines for the Compass Award:

- ❖ Only one video submission per team will be considered. Teams may submit new or updated videos at each

tournament.

- ❖ The video must be submitted at least one week prior to tournament day. Instructions for submitting videos may vary from tournament to tournament. Please check with your tournament's organizer for details.
- ❖ Videos must not be longer than 60 seconds (including introduction and credits if you choose to use them).
- ❖ Videos must be submitted in AVI, WMV or MOV format. Remember that the winning video may be shown on a large screen during the awards ceremony. Use the best resolution you have available for your final version.
- ❖ Team must have rights to any music used on the video.
- ❖ Team must submit an Engineering Notebook.

7.3.10 Judges' Award

During the course of the competition, the judging panel may encounter a team whose unique efforts, performance or dynamics merit recognition, yet doesn't fit into any of the existing award categories. To recognize these unique teams, *FIRST* offers a customizable judges award. The judging panel may select a team to be honored, as well as the name of the judges' award.

7.3.11 Winning Alliance Award

This award will be given to the winning alliance represented in the final match.

7.3.12 Finalist Alliance Award

This award will be given to the finalist alliance represented in the final match.

7.4 Judging Process, Schedule, and Team Preparation

The schedules at the FTC tournaments may vary from site to site. Exact times for both the matches and meeting with judges cannot be given within this manual. All teams receive this schedule prior to or during check-in at the competition.

7.4.1 Judging Process

At FTC Championship Tournaments, there will be three parts to the judging process:

1. Interview with judges
2. Evaluation of performance
3. Evaluation of the Engineering Notebook.

Each team will have an interview with a panel of two or three judges. No awards will be determined on the basis of this interview alone. Judges use the guidelines provided in this chapter to assess each team.

Teams should present their engineering notebooks at the Pit Administration Table during check-in unless otherwise directed by the tournament officials. The engineering notebooks are generally provided to the judges prior to the team interviews.

After the judges review the submitted Engineering Notebooks, complete the initial team interviews and evaluate the team and robot performance during matches, they convene to review their assessments and create a list of top candidates for the various judged awards. Judges may require additional impromptu discussions with teams if necessary. Deliberations are usually completed during the elimination matches. When the judges have finished their deliberations, the engineering notebooks are returned to teams.

Teams are asked to bring their robot to the judge interview. This is the best chance for teams to explain and

demonstrate their robot design to the judges in a quiet and relaxed environment.

7.4.2 Judging Schedule

The judging generally takes place in a separate area away from the noise of the competition and pit. Teams follow the schedule that outlines team interview times and locations. In some cases, teams may receive this information in advance, but more often, teams will receive this information when they check-in on the morning of the event.

Upon arrival, please familiarize yourself with where the judging will occur and allow enough time to get there. To keep this process on time throughout the event, we require that all teams arrive at the judge queuing area five minutes before their scheduled judging interview.

7.4.3 Team Preparation

Teams are encouraged to use the award guidelines to assess where they are within an award category and help them establish higher goals. These guidelines are the same ones used by the judges during each FTC tournament, Super-Regional Championship, and at the FTC World Championship.

The judges want to know highlights about the team; its history and make up; what the team achieved during the competition season; and the experiences that were gained. Team representatives' abilities to answer the questions or elaborate on robot design functions or attributes are evaluated during the team interview. Check with the event organizer to see if Mentors and Coaches are allowed to observe the team interview. Mentors may not contribute to the judging process. Mentors should always keep in mind that FTC is a student-centered activity and it is about giving the students a unique and stimulating experience in all aspects of the program.

7.5 FTC World Championship Event Eligibility

The culmination of the *FIRST* event season is the *FIRST* Championship Event held in St. Louis, MO. This event represents the conclusion of the season for Jr. *FIRST* LEGO League (Jr. FLL), *FIRST* LEGO League (FLL), the *FIRST* Tech Challenge (FTC), and the *FIRST* Robotics Competition (FRC). This is a fun and exciting experience for teams in all programs to participate.

FIRST Tech Challenge teams earn their way to the FTC World Championship with their performance on and off the field. Advancement Criteria for the FTC World Championship is outlined in Section 3.8 and is similar to advancing from local Qualifiers to local Championship tournaments and to Super Regional Championships. Teams are responsible for their own entry fees, lodging, and travel costs to all *FIRST* events.

8.0 Team Resources

8.1 Overview

This chapter provides teams with necessary information for contacting FTC staff, accessing technical support, using the FTC Q&A system, and using the *FIRST* and FTC logos.

8.2 *FIRST* Contact Information

Teams can reach the FTC staff by e-mail at FTCteams@usfirst.org. The office is open Monday through Friday from 9:00 a.m. to 5:00 p.m., EST. Be sure to provide your team number and contact information.

8.3 Getting Answers to your Questions

For general information and questions regarding the FTC, please send an e-mail request to: FTCteams@usfirst.org.

For specific information and questions regarding the FTC program in your area, please contact your region's Affiliate Partner. Search for your area's Affiliate Partner on the FTC web site: www.usfirst.org/regional-contacts.

For questions regarding the annual FTC game (released in September), please have your team leader log into the *FIRST* TIMS (Team Information Management System) to see your FTC team forum login under the 'What's New' information once your team has registered and paid. The FTC Forum opens in September.

Note: Accounts are updated weekly by the *FIRST* IT Department. If you have trouble accessing the forums, please feel free to contact *FIRST* at FTCteams@usfirst.org.

8.4 Rules for Forum Participation

In order to ask official game questions in the FTC Forum, you must register and activate your account. The FTC Game Q&A is accessed directly at ftcforum.usfirst.org or by browsing to forums.usfirst.org and following the "*FIRST* Tech Challenge" link found under the "*FIRST* Programs" heading. Please do not use the FRC Game Q&A for FTC Questions.

Anyone can read this moderated forum. Only a single team leader is allowed to ask questions on the forum. Before posting a question, please make sure it has not already been answered. Game questions are not answered after 11:59 AM EST on Thursday during the competition season. Questions asked after this time are answered after the events have concluded for that weekend. As the forum is moderated, questions and answers will be visible only after they have been reviewed and answered.

For detailed information on the FTC program, robot kit and accessories, playing field, etc., visit the following web pages:

FTC information, game information, FAQs, and team resources: www.usfirst.org/roboticsprograms/ftc/

FTC Game Q&A: ftcforum.usfirst.org

8.5 Team Development Support

In addition to the staff at *FIRST* Headquarters, an additional regional level of support is available through the *FIRST* Tech Challenge Affiliate Partners, *FIRST* Regional Directors, *FIRST* Senior Mentors, and VISTA Volunteers. The FTC Affiliate Partners coordinate all FTC activities within a state, province, or region, and should be your foremost resource for help with the program. To find an Affiliate Partner, Regional Director, Senior Mentor, or VISTA volunteer available in your area, please contact *FIRST* at FTCteams@usfirst.org.

8.6 Using the *FIRST* and FTC Logos

We encourage teams to develop and promote team identity. It is a great way to help *FIRST* judges, announcers, and audiences recognize your team at the competition, and it is also a way to help teams create excitement in their communities.

Teams have incredibly creative opportunities in terms of designing your own identity. There are many examples of how teams brand their efforts with websites, team logos on robots, T-shirts, hats, banners, fliers, and giveaways.

You can download the *FIRST* and FTC logos and Logo Standards information from the FTC web site at: www.usfirst.org/roboticsprograms/resourcecenter.aspx?id=17122. Keep in mind the following when working with the *FIRST* and FTC logos:

Positive Promotion: Use the *FIRST* and FTC logos in a manner that is positive and promotes *FIRST*.

Unmodified: Use the *FIRST* and FTC logos without modification. This means that you will use our name and the triangle, circle, square as you see it on our website or letterhead. You can use it in red, blue, and white, or in black and white.

Modification Permission: If you have an interest in modifying the *FIRST* and FTC logos, you must first contact *FIRST*. Please submit a written request letting us know why you want to modify the logo, how you plan to do it, and where you plan to apply it. Send an e-mail request to the *FIRST* Marketing Department, marketing@usfirst.org.

Advertising Use Approval: All teams and sponsors must obtain approval from *FIRST* prior to incorporating our logo in any advertising. Send an e-mail request for advertising approval to: marketing@usfirst.org.

Appendix 1 - Hardware Inspection Checklist

Team Number: _____

Hardware Inspection Status (circle): **PASS / FAIL**

Team	Inspector	General Robot Rules	Rule #
		Robot fits within the Sizing Box (18" x 18" x 18") without exerting force on box sides or top	RG4
		Robot does NOT contain any components that could damage the playing field or other robots	RG3a&b
		Robot does NOT contain any hazardous materials	RG3c
		Robot poses NO obvious unnecessary risk of entanglement	RG3d
		Robot does NOT contain any sharp edges or corners	RG3e
		Robot Motion Warning Label is attached if servo motors move during the robot initialization routine	RG4b
		Main Power Switch(es) are installed properly, labeled, and readily accessible and visible to competition personnel	RG5, R8e
		All batteries are securely attached to the robot	RG6
		NXT battery can be easily removed with minimal disassembly of the robot	RG7a
		NXT Controller and Samantha Module buttons and USB Ports are readily accessible	RG7b
		NXT Controller liquid crystal display and Samantha LEDs are readily visible	RG7c
		Electrical components are mounted such that they are protected from Robot-to-Robot contact	RG7d
		Robot Flag Holder is present and adequately holds the flag during normal robot operation	RG8
		Team Number is visible from at least 2 sides (180 deg. apart), 3" tall, 1/2" stroke	RG9
		Stored energy is provided by approved sources	RG10
		Game elements launched by the robot do not exceed height and range constraints	RG11
		Robot Parts and Materials Rules	
		All preformed components on the Robot are from the TETRIX, LEGO, and MATRIX robotic systems	R1, R2, R3
		Robot does NOT contain COTS assemblies other than those specifically allowed in the rules	R4, R5
		Robot does NOT contain additional mechanical parts other than the items listed in R6	R6
		Robot has exactly one (1) NXT controller and additional microprocessors comply with R8a	R8a
		Robot has one (1) official NXT rechargeable battery pack (AC or DC) or six (6) AA batteries (not both)	R8b
		Robot has exactly one (1) official TETRIX or no more than two (2) MATRIX main battery packs	R8c
		Exactly one (1) MATRIX Battery Box to power the Samantha Module (Only for MATRIX Robots)	R8d
		Only HiTechnic or MATRIX (not both) motor and servo controllers are used (any quantity is permitted)	R8f
		Maximum of eight (8) TETRIX or MATRIX motors and twelve (12) servos, all controlled by HiTechnic or MATRIX controllers	R8g&h
		Each NXT motor port (A, B or C) controls no more than: (i) one NXT Interactive Servo Motor, or (ii) one XL Power Function Motor, or (iii) two E Power Function Motors, or (iv) two M Power Function Motors, or (v) one E plus one M Power Function Motors	R8i
		Robot has exactly one (1) Samantha module and one (1) USB cable (and optional pigtail)	R8j
		All sensors attached directly to the NXT, HiTechnic Sensor Multiplexor, or HiTechnic Touch Sensor Multiplexor are LEGO or HiTechnic products	R8k
		HiTechnic 9-volt Battery Box (if used) is only used as part of the NXT Sensor Multiplexor	R8m
		HiTechnic SuperPro Prototype Board and NXT Prototype Board comply with the specified constraints	R8n
		Only LEGO approved NXT extension and conversion cables are used	R8o&p
		Electrical connectors are Anderson PowerPole, crimp, or quick connect styles	R8q
		Power, motor control, servo and encoder wires are the correct size	R8r
		Only visible light LEDs are used and powered by either the main battery or no more than one battery of any type not to exceed 9 volt	R8s
		Robot contains only specifically allowed electrical components and the electrical components Have NOT been modified from their original state except as permitted by the rules	R8v&w
		Video recording devices, if used, are non-functional and don't have wireless communication capability	R8y
		LEGO Pneumatic Elements have NOT been modified to change their pressure limits	R9
		Decorative components used on the robot are constructed with allowed parts or they are non- functional. Decorations are in the spirit of Gracious Professionalism	R13

General Comments or Reason(s) for Failure (if any):

I hereby state that all of the above is true, and to the best of my knowledge all rules and regulations of the *FIRST* Tech Challenge have been abided by.

Hardware Inspector

Team Student Representative

Appendix 2 - Software Inspection Checklists

Team Number: _____

Overall Software Inspection Status (circle): **PASS / FAIL**

Queuing Area Checklist:

Team	Inspector	Drive Team Members Present	Rule #
NA		Coach	
NA		Driver1	
NA		Driver 2 (optional)	
		NXT Configuration	
NA		Samantha unit has the latest firmware and competition connection settings flashed to it (See Instructions Below)	
		NXT named with team number (optional hyphenated letter appended)	RS2
		NXT Firmware Version (circle one)	
		LabVIEW - 1.31 or newer ROBOTC - 9.0 or newer	RS3
		Samostat program is loaded on the NXT	RS4
		Program Chooser program is loaded on the NXT	RS5
		NXT Sleep Timer set to NEVER	RS6
		Queuing Process	
		Team understands that no software changes are allowed in Queue Area.	
		Team understands that the match schedule is only an estimate. Matches may start prior to or after the scheduled time and it is the teams' responsibility to monitor schedule changes and show up when required.	
NA		Team knows where to receive alliance flags and where to return them after the match.	

I certify that the robot is in the proper software configuration.

Queuing Area Inspection Completed by: _____

How to Flash Samantha For Competition at Software Inspection:

1. Obtain the flash drive created by the FTA/FCS Operator with the Samantha.hex file and network key folders loaded.
2. Turn off the power to the Samantha Module.
 - a. TETRIS – Turn off the main robot power switch
 - b. MATRIX – Turn off/disconnect the MATRIX Battery Box
3. Remove the NXT USB cable from Samantha and insert the flash drive into the USB port on the Samantha.
4. Hold down the red button on the Samantha, then power on the Samantha Module. Release the red button when the LEDs on the Samantha light up.
5. The Samantha LEDs will complete TWO cycles of: Red-White-Blue-White-Red.
6. After two full light cycles are complete (approximately 40-seconds), remove the flash drive from the Samantha and reconnect the NXT USB cable.

Important: ENSURE two full LED light cycles complete before removing the flash drive from the module. Repeat the steps if two full LED light cycles are not observed.

Field Inspection Checklist:

Team	Inspector	Field Setup	Rule #
NA		Connection with tournament-supplied FCS is successful	RS7
		Robot Setup procedure on the field is understood by the team and is successful	
		Robot Functionality	
		(Optional) Robot successfully ran an Autonomous program	
		Robot did not move prior to the start of the Autonomous period except for servo initialization	RS8
		Robot did not move between the Autonomous and Driver-Controlled periods	RS8
		Robot's Driver-Controlled mode started when commanded to do so by the FCS	
		Robot stopped at the end of the Driver-Controlled period	
		Match Process	
NA		Team understands how to call for FTA assistance during a match	
		Team understands they cannot touch any robot or field element after the match ends until instructed to do so by the referees	
		Teams understand they are to clear the alliance station as soon as the match ends with one team member remaining behind to collect the robot	

I hereby certify that this team has demonstrated their understanding of the match process, their ability to properly control their robot, and that their robot operates as required during a match.

General Comments or Reason(s) for Failure (if any):

I hereby state that all of the above is true, and to the best of my knowledge all rules and regulations of the *FIRST* Tech Challenge have been abided by.

Software Field Inspector

Team Student Representative