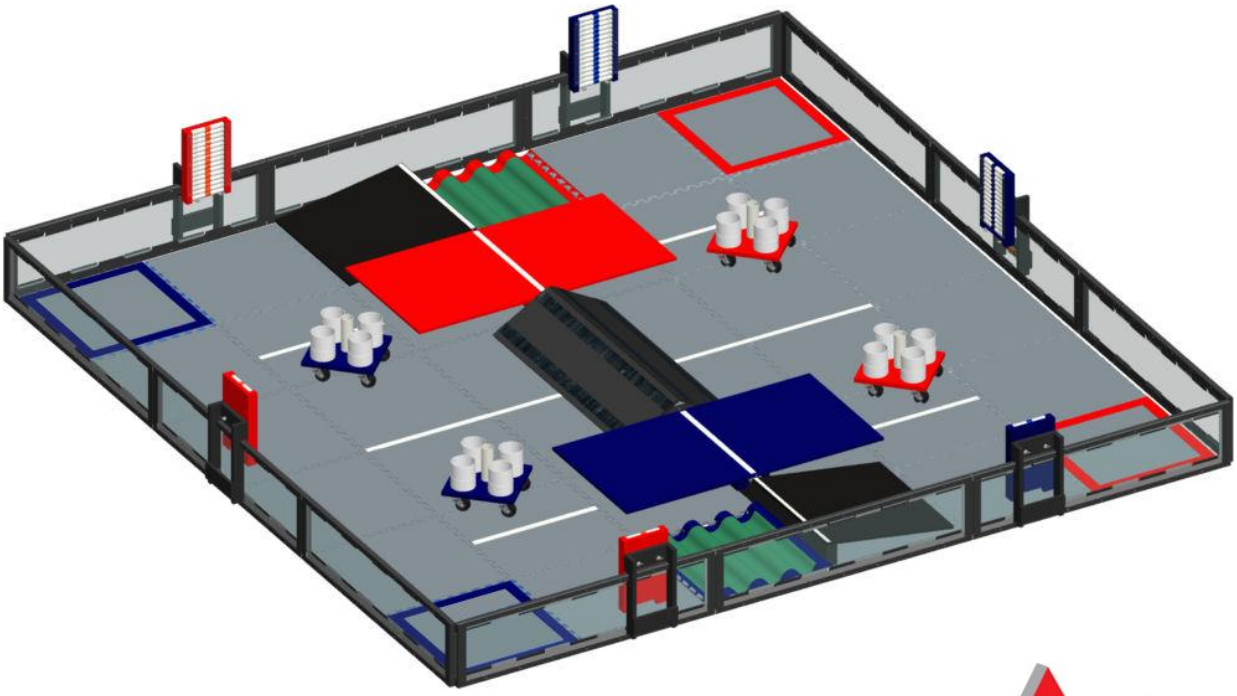
GET OVER IT™

GAME MANUAL

2010 - 2011



FTC
FIRST® Tech Challenge

Rev. 2 9/22/2010

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Revision	Date Released	Details
1	9/11/2010	Initial Release
2	9/21/2010	Section 2, Definitions: Clarified definition of "Possession of a Baton" Section 2, Definitions: Added definition of "Possession of a Rolling Goal" Section 2.4.1 (6): Balancing rule separated from previous rule. Section 2.4.1 (7): Scoring: Clarified how a baton is counted as scored in the rolling goal. Section 2.4.5 <SG3>: Dispensing an opponent's Doubler Baton will result in a disqualification. Added to Penalty Summary table. Section 2.4.5 <SG8>: Clarified rule on grasping the rolling goal. Section 4.2, <R5>b,2: Corrected model number of DC Battery to W979693. Section 4.2, <R5> c, 29: Added part number reference for #25 chain off-set link.

SECTION 1 – INTRODUCTION

1.1 – OVERVIEW

This section provides an introduction to *FIRST* and the *FIRST* Tech Challenge program.

1.2 – ABOUT *FIRST*

> "…to create a world where science and technology are celebrated… where young people dream of becoming science and technology heroes."
>
> *FIRST* Founder, Dean Kamen

FIRST

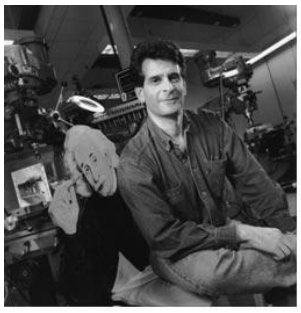
FIRST (For Inspiration and Recognition of Science and Technology) was founded by inventor Dean Kamen to inspire young people's interest and participation in science and technology. Based in Manchester, New Hampshire, *FIRST* is a 501(c)(3) not-for-profit public charity.

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 90,000 committed and effective volunteers who are key to introducing close to 250,000 young people to the joy of problem solving through engineering.

FIRST provides four programs: the *FIRST* Robotics Competition (FRC) and the *FIRST* Tech Challenge (FTC) for grades 9-12; ages 14-18*, *FIRST* LEGO® League (FLL) for 9 to 14 year-olds, and Junior *FIRST* LEGO League 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,
FIRST Founder



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*.

**May include 8th grade students 13 and older who are prepared to enter a high-school program.*

1.3 – WHAT IS THE *FIRST* TECH CHALLENGE?

FIRST Tech Challenge (FTC) is the newest addition to the family of *FIRST* programs. FTC grew out of a need for a mid-level robotics program to transition teams from *FIRST* LEGO League to *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.

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 that expand the boundaries of experimental intelligence.

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.

1.4 – 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!"

The *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. The *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 the 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.

1.5 – THE *FIRST* TECH CHALLENGE – 2010 SEASON

FIRST Tech Challenge teams will participate in the *GET OVER IT!* Challenge for the 2010-11 season. Each game match is made up of two distinct types of play – driver-controlled and autonomous. Each tournament features alliances of two teams playing side-by-side on the playing field. Alliance partners will compete to score the most points by completing various tasks, including emptying baton dispensers filled with 6-inch long PVC tubes and scoring them in stationary and rolling goals. Teams are challenged to complete tasks during autonomous and driver-controlled periods and will score batons for extra points and possibly double points for a goal at the end of a match.

During an exciting build period, teams work as a group to overcome obstacles and meet challenges while learning from and interacting with their peers and adult mentors. Teams work together to build a robot that will be able to successfully complete the challenge set forth at Kickoff. Students come away with a greater appreciation of science and technology and how they might use it to positively impact the world around them. In addition, they cultivate life skills such as planning, brainstorming, collaboration, teamwork, leadership as well as research and technical skills.

Teams also work together to achieve the mission of *FIRST* and the *FIRST* Tech Challenge. Teams perform community outreach events, mentor *FIRST* LEGO League (FLL) Teams and Jr. FLL Teams in their area. They participate in fund raising and marketing events which make the general public aware of their activity and inspire others in the field of Engineering, Science, and Mathematics.

Teams are allowed to compete in as many Tournaments as they would like but can only qualify to advance to the FTC World Championship at their first three regional championship events. The *FIRST* World Championship Event in St. Louis, MO is an exciting event where teams from FTC, FRC, and FLL celebrate their accomplishments with other teams, family, and friends. Eligibility requirements for the FTC World Championship will be released after Kickoff on the www.usfirst.org website.

SECTION 2 – THE GAME

2.1 – OVERVIEW

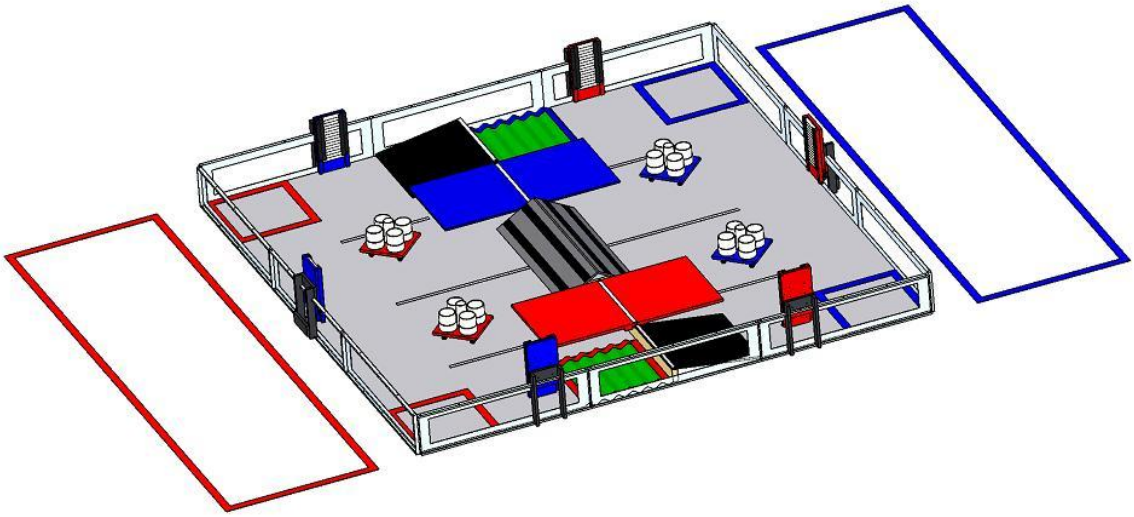
This section describes the *FIRST* Tech Challenge game for the 2010 season, called *GET OVER IT!* It also lists the game definitions and game rules.

2.2 – GAME DESCRIPTION

Matches are played on a playing field initially set up as illustrated in the figures below. Two Alliances – one “red” and one “blue” – composed of two teams each, compete in each match. The object of the game is to attain a higher score than your opposing Alliance by placing 6-inch long PVC batons into several Alliance-colored scoring goals (rolling and stationary) located on the playing field.

In the Autonomous Period, teams are rewarded for moving over the field elements in the middle of the field as well as collecting batons that they use to score during the period. Parking a robot on the different field elements by the end of the Autonomous Period is also worth points. Batons scored during the Autonomous Period may be scored a second time at the end of the match.

There are a total of 100 batons available to both teams as scoring objects in the game. Five batons are given to each Alliance to pre-load onto the robots in any way they want and 90 will be placed in the Baton Dispensers located around the field - 15 per Dispenser. A Doubler Baton will be available in each Alliance's middle Baton Dispenser to be dispensed during the Autonomous Period (if not dispensed, it is removed by a referee). There are also two Magnet Batons per Alliance placed randomly in the Baton Dispensers. These batons are worth extra points if scored in the center cylinder of an Alliance's rolling goal. Robots may only make contact with their Alliance's baton dispenser (located on the other side from their starting position).



Note: The illustrations in this section of the manual are only provided to give a general visual understanding of the game.

Teams should refer to the official field drawings available at www.usfirst.org under FTC Team Resources for exact field dimensions, a full field Bill of Materials (BOM) and the exact details for field construction. Items listed in the full field BOM are recommended for an official Field Kit. Suitable substitutions are acceptable. Lower cost field options are also provided at www.usfirst.org

2.3 – GAME DEFINITIONS

Alliance – A pre-assigned grouping of two teams that work together for a given match.

Alliance Station – The designated region where the drivers and coach stand or move within during matches.

Autonomous Period – A 40-second period in which the robots operate and react only to sensor inputs and to commands pre-programmed by the team into the onboard robot control system. Human control of the robot is not permitted during this time.

Balanced – The Bridge is said to be balanced if it is not touching the field mat nor touching another element on the field mat (i.e. a Baton, Rolling Goal, or Robot).

Any object on a balanced bridge cannot be touching anything not on the bridge.

Baton – A scoring element for the 2010 *FIRST* Tech Challenge game, *GET OVER IT!* The baton is a 1/2 inch Schedule 40 PVC pipe that is six (6) inches in length. The 1/2 inch PVC pipe is a nominal size – actual dimensions vary, but typically it has an Outside Diameter (O.D.) of 0.84 inches. There are three types of Batons: Regular, Doubler, and Magnet.

Regular Batons – These are ordinary white 6" PVC pipes. There are 84 loaded into the *Baton Dispensers* and 5 others per *Alliance* available to pre-load onto robots before the start of a match. The Batons have red or blue gaffers tape in the center to facilitate field reset. The batons that will be preloaded will also be marked with two pieces of gaffers tape.

Doubler Batons – These batons are completely painted in red or blue to signify Alliance colors. There is only one of each color. These are loaded as the first baton to be available in the *Middle Baton Dispenser* per side. If the Doubler Batons are not dispensed during the *Autonomous Period*, they will be removed from play by a Referee. Doubler Batons double the score of all batons in the goal in which they are scored.

Magnet Batons – These look like Regular Batons, however, they have a magnet hidden inside. There are four of these batons, two in the red Alliance Baton Dispensers and two in the blue Alliance Baton Dispensers placed at random locations.

Baton Dispenser – A mechanism that holds the batons at the start of the match. There are three (3) *Baton Dispensers* per Alliance located across the field from the *Alliance Station*. Alliance robots may only interact with their corresponding Baton Dispensers. Each Baton Dispenser is placed at different heights – High, Middle, and Low. The *High Baton Dispenser* is located farthest away from the audience. The *Middle Baton Dispenser* is located on the alliance station wall, centered on the field. The *Middle Baton Dispenser* has an IR Beacon attached to it to aid in robot navigation. The *Low Baton Dispenser* is located on the wall closest to the audience.

Coach – A student or adult mentor designated as the team advisor during the match and identified as the person wearing a "coach" badge or identifying marker.

Competition Area – The area where all the Playing Fields, Alliance Stations, scoring tables, and other event officials and tables are located.

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

Driver – A pre-college student team member responsible for operating and controlling the robot and wearing a "Driver" badge or identifying marker.

Driver-Controlled Period – The two-minute time period in which the drivers operate the robots after the Autonomous Period.

End Game – The last thirty (30) seconds of the Driver-Controlled Period at the end of the match. During the End Game, robots may not make contact with their opposing Alliance's Bridge.

Field Control System (FCS) – The Field Control System is the computer program that will serve as the communications system between the drivers and the robot during each match.

Match – A match consists of an autonomous period followed by a driver-controlled period for a total time of two minutes and forty seconds (2:40).

Parked – A robot is successfully parked if it is only touching the Cliff, the Bridge, the Mountain, or other parked robot and nothing else.

Penalty – A deduction to the Alliance's score assigned by a Referee for a rules violation.

Pin / Pinning – One robot preventing the movement in all directions of an opposing robot while in contact with the playing field, one or more field elements, or another robot.

Playing Field – The part of the Competition Area that includes the 12'x12' field, borders, and the Baton Dispensers. The 12'x12' field is divided into two halves (a Starting side and a Dispensing side) by several on-field playing elements – the *Mountain*, the *Bridges*, and the *Cliffs.* The blue Alliance's starting side of the field is the same as the red Alliance's dispensing side of the field. The red Alliance's starting side of the field is the same as the blue Alliance's dispensing side of the field.

Mountain – The center structure that robots may navigate up and over to get to the other side of the field. Each side of the *Mountain* is made of a piece of 1/2" MDF Plywood. There is non-slip tape placed on both sides of the Mountain to help robots gain traction.

Bridges – There are two Bridges on either side of the Mountain that are balanced on 2x4 boards. There is one Red Bridge and one Blue Bridge. A Bridge is made of a piece of 1/2" MDF Plywood. Bridges have a natural balance point so that they don't touch the playing field mat unless acted upon by another object.

Cliffs – There are two Cliffs on the outside of the Bridges (between the Bridges and the border walls) that serve as a small ramp to the low goal. The Cliff is made of a piece of 1/2" MDF Plywood.

Possess / Possessing a Baton -Controlling the position and movement of a BATON. A BATON shall be considered in POSSESSION if, as the ROBOT moves or changes orientation (e.g. backs up or spins in place), the BATON remains in approximately the same position relative to the robot.

Possess / Possessing a Rolling Goal- Controlling the position and movement of a ROLLING GOAL. A ROLLING GOAL shall be considered in POSSESSION if, as the ROBOT moves or changes orientation (e.g. backs up or spins in place), the ROLLING GOAL remains in approximately the same position relative to the robot.

Robot – Any mechanism which has passed inspection that a team places in their corresponding Starting Location prior to the start of a match. A more detailed definition of Robot also appears in the Robot Rules and Inspection sections.

Scored – A baton is scored if the baton is not *Possessed* by a robot of the same Alliance color as the goal and is a) for the Stationary Goal: completely within the space extending infinitely above the corresponding Scoring Areas; b) for the Rolling Goal: if the baton is placed approximately vertically within one of the PVC cylinders located on the goal. Batons can only be scored once. For example, if the Rolling Goal is pushed into the Stationary Goal area, batons scored in the Rolling Goal will score ONLY for the Rolling Goal regardless of Alliance color.

Scoring Areas – There are two (2) scoring areas where batons may be scored – a Stationary Goal and two Rolling Goals per Alliance. Batons will be counted for the corresponding Alliance color based on where they are scored (not what color the baton may be taped or painted). For example, a regular baton taped for the Blue Alliance may count for the Red Alliance if it is scored in the Red Stationary Goal or Red Rolling Goal.

Stationary Goal – Each Alliance's *Stationary Goal* is located on the same side and to the right of the field as their Alliance Station. The goal is made up of corrugated plastic which replaces one of the field tiles. Due to regional availability, the corrugated sheet may vary slightly from event to event.

Rolling Goal – There are two *Rolling Goals* per Alliance made of a sheet of 3/4" plywood resting on 4 casters. On top of the plywood are four 4" PVC cylinders. In the center of the platform is a 2" PVC cylinder.

Starting Location – The location where teams place their robots before the start of the match. There are two starting locations per Alliance on the playing field located in front of the corresponding Alliance station. The robot may start in any orientation anywhere within and including the taped boundary.

2.4 – GAME RULES

2.4.1 – SCORING

1. A Regular or Magnet Baton that is scored in the Stationary Goal is worth one (1) point for the corresponding Alliance.
2. A Regular or Magnet Baton that is scored in the 4" PVC cylinders of the Rolling Goal is worth three (3) points for the corresponding Alliance.
3. A Regular Baton that is scored in the 2" PVC cylinder of the Rolling Goal is worth zero (0) points for the corresponding Alliance.
4. A Magnet Baton that is scored in the 2" PVC cylinder of the Rolling Goal is worth twenty-five (25) points for the corresponding Alliance.
5. The Doubler Baton will double the score for all batons in the corresponding goal.
6. Balancing elements on the Alliance's corresponding Bridge at the end of the match will be worth points on a sliding scale as follows:
    a. 1 element (Robot or Rolling Goal) = 10 points
    b. 2 elements (Robots or Rolling Goals) = 20 points

c. 3 elements (Robots and Rolling Goals) = 30 points
d. 4 elements (Two robots and two Rolling Goals) = 40 points

7. In order to score, a portion of the Baton must be inside the cylinder, i.e., break the plane defined by the top circular face of the PVC cylinder.

2.4.2 – SCORING IN AUTONOMOUS PERIOD

Referees record the score at the end of the Autonomous Period. Batons scored during the Autonomous Period are eligible to be scored again at the end of the Match. Additionally, the following scores are calculated at the end of the Autonomous Period:

1. Parking a robot on a Cliff is worth 3 points.
2. Parking a robot on the Mountain or any unbalanced Bridge is worth 5 points.
3. Parking a robot on any balanced Bridge is worth 15 points.
4. Having a robot on the Dispensing side of the field (over the Cliffs, Bridge, or Mountain) is worth 10 points. The robot must be completely on the Dispensing side of the field in order to count and may not be touching the Mountain, Cliffs, or Bridges.
5. Dispensing any Batons from an Alliance's Baton Dispenser on their Dispenser Side of the Playing Field is worth 2 points per baton.

2.4.3 – SAFETY RULES

<S1> If at any time the robot operation is deemed unsafe or has damaged the playing field, another robot, field elements, surface, or borders, by the determination of the referees, the offending team may be disqualified. The robot will require re-inspection before it may again compete.

Note: Teams should pay close attention to other Robot Specific Safety Rules outlined elsewhere in other sections of the Game Manual.

<S2> If a robot goes completely out-of-bounds (outside the 12'x12' portion of the playing field), it will be disabled for the remainder of the match.

Note: The intent is NOT to penalize robots for having mechanisms that inadvertently cross the 12'x12' border walls during normal game play.

2.4.4 – GENERAL GAME RULES

<G1> At the beginning of a match, each robot must not exceed a volume of 18"wide by 18" long by 18" tall. An offending robot will be removed from the match at the Head Referee's discretion.

a. Alignment devices (templates, tape measures, lasers, etc.) that are not part of the robot may NOT be used to assist with the positioning of the robot.

<G2> Each Drive Team shall include up to two drivers and one coach.

<G3> During a match, the drivers and coach must remain in their Alliance Station and cannot make any contact with the playing field. The first instance of leaving the Alliance Station will result in a warning, with any following instances resulting in a penalty or disqualification.

<G4> Drivers and coaches are prohibited from making intentional contact with any game or field object. The first instance of intentional contact will result in a warning, with any following instances resulting in a penalty or disqualification.

<G5> During a match, robots must be remotely operated only by the Drivers and/or by software running in the on-board control system. The first instance of coach interference will result in a warning, with any following instances resulting in a penalty or disqualification.

<G6> Scores will be calculated for all periods of a match when all objects on the playing field have come to rest.

<G7> Robots may not intentionally detach parts during any match, or leave mechanisms on the playing field. If a detached component or mechanism is attached to the scoring area and prevents additional scoring, the team will be disqualified. Multiple infractions may result in disqualification for the entire competition.

<G8> Strategies and mechanisms aimed solely at the destruction, damage, tipping over, or entanglement of robots or scoring areas are not in the spirit of the *FIRST* Tech Challenge and are not allowed. However, *GET OVER IT!* is a highly interactive contact game. Some tipping, entanglement, and damage may occur as a part of normal game play. If the tipping, entanglement, or damage is ruled to be intentional, the offending team may be disqualified for that match. Repeated offenses could result in a team being disqualified from the remainder of the competition.

<G9> A robot cannot pin another robot for more than five seconds. If a referee determines this rule is violated, the offending Alliance will receive a penalty and the offending robot may be disabled for the match. A robot cannot incur a pinning penalty during Autonomous Mode. If a pinning occurrence happens during Autonomous Mode, the first action done by the offending robot during the Driver-Controlled Period must be to back away from the pinned robot or a penalty will be assessed.

<G10> The actions of an Alliance or their robots shall not cause an opposing Alliance or robot to break a rule and thus incur penalties. Any rule violations committed by the affected Alliance shall be excused, and no penalties will be assigned.

<G11> Robots must be designed to permit easy removal of scoring elements from any grasping, containing, or holding mechanism without requiring that the robot have power after the match.

<G12> Field tolerances may vary by as much as +/-1.0” and baton tolerances may vary as much as +/- 0.25”. Teams must design their robots accordingly.

<G13> At the beginning of each match, each Alliance robot must be set up onto the playing field in the starting location ready to begin play. Robots may be placed in either of the alliance’s starting

locations. Drive teams are required to stand in the alliance station location specified by the match schedule to assure that the Logitech controllers are assigned to the correct drive team and robot.

a. During the qualification matches, the red Alliance robots must be set up on the playing field first.
b. During the elimination matches, the lower seeded (i.e. 3rd seed is lower than 2nd seed) Alliance robots must be set up on the playing field first.
c. Alliances may waive their right to place their robots on the playing field after the opposing alliance places their robots as specified above.

<G14> Matches are replayed at the discretion of the Head Referee and Field Technical Advisor (FTA) only under the following circumstances:

a. Failure of an on-field game element that was likely to have impacted which Alliance won the match.
b. Loss of control of a robot due to a VERIFIABLE failure of the tournament-supplied FCS computer, FCS software, USB Hub, or Logitech Game Controller.
c. Loss of control of all four robots due to a failure of the field's wireless router.

Unexpected robot behavior in itself will not result in a match replay. Team induced failures, such as low battery conditions, processor sleep timeouts, robot mechanical/electrical/software failures, robot communication failures, etc. are not valid justifications for a rematch.

2.4.5 – GET OVER IT! SPECIFIC GAME RULES

<SG1> Prior to the start of each match, each Alliance will have five (5) Regular Batons available to preload into their robots.

a. A Baton is considered to be legally preloaded if it is touching the robot and not touching any part of the field mat, other field elements, or border wall. ONLY Pre-loaded Batons may extend beyond the 18" cube starting volume limit.
b. The preloaded batons can be loaded onto the robots in any number not to exceed five (5).
c. Batons not preloaded will remain out of play for the duration of the match.

<SG2> There are 15 Batons placed in each of the Baton Dispensers before the beginning of the match. The Doubler Baton will be placed as the first Baton to be available in the Middle Baton Dispenser for each Alliance. The Magnet Batons will be placed in a random order in any of the Baton Dispensers, but only two will be available to each Alliance. Teams are not allowed to touch or reposition the Batons or the Baton Dispensers in any way prior to the start of, or during a match. Repeated violation of this rule may result in team disqualification

<SG3> Robots may only contact and use the Baton Dispensers of their corresponding Alliance. Each violation of this rule will result in a penalty for the Alliance. Batons that have been dispensed and land on the field mat can be possessed and scored by any robot. Dispensing the opposing Alliance's Doubler Baton will result in a disqualification.

<SG4> Robots may only *Possess* a Baton not in possession of a robot from the opposing Alliance. It is legal for robots on the same Alliance to give Batons to each other. Violation of this rule will result in a penalty for the Alliance.

<SG5> Robots may not *Possess* more than five (5) Batons at any time. Each violation of this rule will result in a penalty for the Alliance

<SG6> The Doubler Baton may be scored in any goal at any time of the game. If the Doubler Baton is not dispensed during the Autonomous Period, it will be removed from play by a Referee.

<SG7> Batons that leave the 12'x12' area of the playing field will be placed back in play at the earliest safe opportunity by a designated game official. Batons will be placed onto the playing field at the approximate location where it exited unless it will score. Drive Teams are not allowed to return batons onto the playing field. Violation of this rule will result in a penalty for the team and may result in a team disqualification.

<**SG8>** Robots may not intentionally lift, grasp or hold any of the Rolling Goals at any time except during the End Game. Rolling Goals may only be pushed around the field or over the Bridges, Cliffs, or Mountain. Violations of this rule will result in a penalty for the team. Sustained lifting, grasping or holding of a Rolling Goal outside of the End Game will result in additional penalties for each 5 seconds of grasping. Multiple infractions may result in disqualification for the offending team.

<SG9> Removing (de-scoring) batons from only the Stationary Goal is allowed. Intentional de-scoring of batons from the Rolling Goal will result in a team disqualification. Intentional tipping over of the opposing Alliance's Rolling Goal (either empty or full) will result in a team disqualification.

<SG10> Batons that are de-scored due to the tipping of a Rolling Goal by the opposing Alliance will be counted as being scored.

<SG11> During the End Game:

a. Robots may only make contact with the Bridge of their corresponding Alliance. Robots may not touch or interfere in any way with the balancing of the opposing Alliance's Bridge. This includes pushing Rolling Goals or Batons under or onto the Bridge. Each violation of this rule will result in a penalty.
b. Robots may make contact with their own alliance's Rolling Goal and lift, grasp, or hold it for the purposes of balancing on the Bridge. Any batons that fall out of their own Rolling Goal as a result of this action will not be counted.

2.4.5 – GET OVER IT! PENALTY SUMMARY

The following table shows the possible rule violations and their ramifications:

Violation	Ramification	Rule
Drive team outside of Alliance Station	Warning; followed by 5 points per offense May lead to disqualification for match	<G3>

Violation	Ramification	Rule
Drive team contacts field or game object	Warning; followed by 5 points per offense May lead to disqualification for match	<G4>
Coach touches Game Pad joystick controller after start of match	Warning for first offense. Repeated offense will result in a 40 point penalty per offense May lead to disqualification for match	<G5>
Robot intentionally detaches parts in scoring area	Robot disabled and team disqualified for match. Multiple infractions may result in disqualification for the entire competition.	<G7>
Intentional tipping, entanglement, or damage	Robot disabled and team disqualified	<G8>
Pinning	5 points per offense May lead to disqualification for the match	<G9>
Drive Team touching or repositioning the Batons	May lead to disqualification for the match	<SG2>
Dispensing the opposing Alliance's Doubler Baton	Disqualification for the match	<SG3>
Making contact with the opposing Alliance's Dispenser or Dispensing the opposing Alliance's Batons	5 point penalty per occurrence	<SG3>
Taking a Baton from a robot on the Opposing Alliance	5 point penalty per occurrence	<SG4>
Possessing more than 5 batons	5 points for each Baton over 5 per offense	<SG5>
Drive team touching batons during a match	5 points per offense May lead to disqualification	<SG7>
Intentionally lift, grasp, or hold any of the Rolling Goals except your own during End Game	5 points per offense	<SG8> <SG11>
Intentional de-scoring of batons from the Rolling Goal or tipping over of the opposing Alliance's rolling Goal	Disqualification for the match	<SG9>
Making intentional contact or interfering with the balancing of the opposing Alliance's bridge during the End Game	40 points per offense	<SG11>a

SECTION 3 – THE TOURNAMENT

3.1 – OVERVIEW

The *FIRST* Tech Challenge will be played in a tournament format. Each tournament will include practice, qualifying, and elimination matches. After the qualifying matches, teams will be ranked based on their performance. The top teams will then 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/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 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.

Alliance Selection – The process of choosing the alliances for the Elimination Matches.

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 will proceed to the next round.

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

Qualifying Match – A match used to determine the rankings for the Alliance Selection. Alliances compete to earn Qualifying Points and Ranking Points.

Qualifying Points (QPs) – The first basis of 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 awarded in the amount of the final score of the losing alliance in a Qualifying Match. Ranking points are used as the tiebreakers when teams have equal Qualifying Points.

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 Qualification match schedule.

3.3 – TOURNAMENT EVENT AGENDAS

Schedules will be available through your local FTC Affiliate Partner prior to or at your tournament.

3.4 – COURTESIES AND RULES

You will hear the expression Gracious Professionalism often throughout your involvement in the *FIRST* Tech Challenge. 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 and/or repair competing robots, and helping rookie teams avoid preventable pitfalls. These are examples of some side benefits of being involved with this organization.

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

Bands:	No live bands in the audience or pit.
Battery Safety:	Charge your batteries in an open, well-ventilated area.
Fire Extinguishers:	Located at the pit administration station and in the competition area.
Food:	You should 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.
Music/Noise:	No loud music, audio systems, whistles, banging sticks, blow horns, etc. They prevent teams from hearing important announcements. Power may be shut off and/or noise makers confiscated.
Internet/Wireless Network Access:	Teams may not setup a wireless computer network for any purpose (ie. 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.
Sales:	Because of site regulations/contracts, *FIRST* cannot allow teams or individuals to sell items, such as T-shirts, pins, etc. at any events.
Seat Saving:	Not allowed, we need seats to get the public comfortable and interested.
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 safety rules listed below.
Safety Glasses:	All team members and onlookers must wear safety glasses in the pit and near the competition area. If you wear prescription glasses, you must wear safety goggles over them or attach safety side shields to them. Teams are required to bring enough safety glasses/goggles to supply its team members and its guests.
Running:	There will be no running in the pit.
Painting:	There will be no painting in the pit.

Soldering, Gluing, Brazing, or other Large Power Tools:	At the discretion of the Tournament Director, these items are not allowed in the pit areas or at the competitions. Contact your Affiliate Partner for alternatives.

3.5 – EYE PROTECTION AND SAFETY

FIRST requires all teams to bring and supply safety glasses for its members and guests for each competition. Students and adult team members and guests must wear them to protect their eyes while working on the robot, when observing robot building/repair work, and while competing.

All team members and their guests, including coaches, must wear safety glasses or prescription glasses with side shields while in the pits or alliance stations during matches. Additionally, safety goggles that fit over or safety side shields that attach must be used with normal prescription glasses.

Only use ANSI-approved, *non-shaded safety glasses with approved side shields.

**(Rose, Blue, and Amber tints are FIRST approved, but reflective lenses are not.)*

3.6 – EVENT DAY OVERVIEW

An overview of the event and tournament will generally follow the following agenda:

1. Team Registration
2. Robot and Software Inspection
3. Judge's Interviews
4. Practice Matches
5. Opening Ceremony
6. Qualification Matches
7. Alliance Selection
8. Elimination Matches
9. Awards and Closing Ceremony

3.6.1 – TEAM REGISTRATION

As a team arrives at the venue, the Coach or other adult mentor should register the team with the tournament officials. During registration, 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 such as where the practice and playing fields are, where judging will take place, and understand the schedule.

3.6.2 – ROBOT AND SOFTWARE INSPECTION

FTC robots will be required to pass hardware and software inspections before being cleared to compete. This inspection will ensure that all FTC robot rules and regulations are met. Initial inspections will take place during team registration/practice time. A copy of the official FTC "Robot Inspection Sheet" is located in another section. The "Robot Inspection Sheet" should be used as a guide to pre-inspect the robot prior to tournament day.

3.6.3 – JUDGE'S 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" discussion/interview with a panel of two or three judges. The Judge's Interviews generally take place before any qualification matches take place 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 available; the entire team/robot is encouraged to participate. Mentors (no more than two) are welcome to observe the Judge's Interview, but may NOT participate.

3.6.4 – PRACTICE MATCHES

At the event, practice matches may be played in the morning during the team registration time until the drivers' meeting begins. Every effort will be made to equalize practice time for all teams, but may also be conducted on a first-come, first-served basis. These matches may be scored, but the scores do not affect team ranking.

3.6.5 – 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 first Qualification Match takes 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. Matches begin right after its conclusion. Please, make sure your team is on time in case you have an early match.

3.6.6 – QUALIFICATION MATCHES

The qualifying match schedule will be available prior to opening ceremonies on the day of the event. This schedule will indicate alliance partners and match pairings. It will also indicate the alliance's color (red or blue) and the position in the alliance station (1 or 2) for the drive team. Robots may be placed in

either of the alliance's starting locations. These matches will start immediately after the Opening Ceremonies in accordance with the qualification match schedule. The queue team will work together throughout the day to line up teams for the matches and maintain the schedules. It is very important to pay attention to the match schedule and listen for announcements throughout the day. You will need to know when you will compete, find out the number of the ending match before lunch, and which match is the last match of the tournament day.

Teams will be randomly assigned to matches and alliances. All teams will be scored based on the same number of qualifying matches. In some cases, a team will be asked to play a surrogate match which will not count towards their standings during the event. This additional match will be denoted on the match schedule and/or announced to the teams prior to the start of the qualifying matches.

At the conclusion of each match, Qualifying Points (QP) will be awarded:

- Winning teams of a qualifying match 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.

Teams will also receive Ranking Points (RP) based on the following:

- The number of ranking points assigned for each match, is that of the losing alliance's score.
- In the event of a tie, both alliances will receive the same RP (equal to the tie 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 will be 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 will receive zero (0) QP and zero (0) RP.

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

3.6.7 – ALLIANCE SELECTION

The number of teams in the Elimination Matches will be based on the number of teams in the tournament and the schedule of the day determined by the tournament director. If there are 21 or more teams in the tournament, the Elimination Matches will consist of alliances of 3 teams each. If there are

20 teams or less, then the alliances will consist of 2 teams each. There will be a total of four (4) alliances that will compete in the Elimination Bracket.

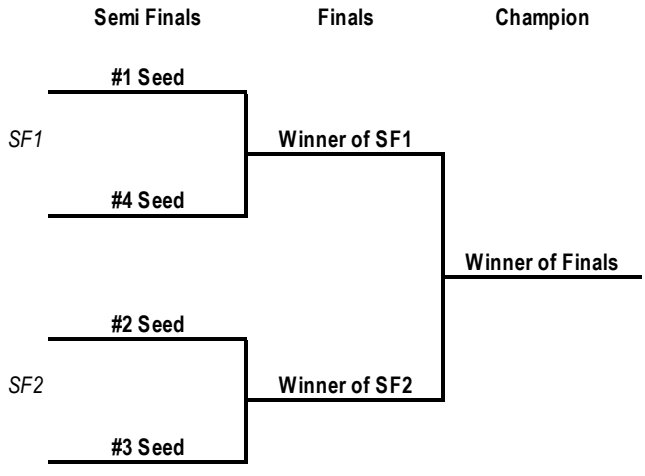
During alliance selection, captains offer an invitation to another team to form the final alliances that will compete in the elimination matches. Selection rounds continue until all final alliances have been formed.

The alliance selection process is as follows:

- Each team will choose 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 will be asked to step forward as the Alliance Captain to invite another available team to join their alliance.
- A team is available if they are not already part of an alliance, or have not already declined an alliance invitation. If the team accepts, it is moved into that alliance. If a team declines, they CANNOT be invited into another alliance, but are 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. Any teams remaining after the lowest seeded captain makes their choice will not compete in the Elimination Matches.

3.6.8 – ELIMINATION MATCHES

The Elimination Matches are very exciting in where the alliances determine who will be the Champion of the event. The matches are played in a seeded ladder format where the top seed goes up against the lowest seed, 2nd best seed vs. the 2nd lowest seed, and so on.



In the elimination matches, teams do not get qualifying points; they get a win, loss or tie. Within each bracket of the Elimination Match Ladder, matches will be played to determine which alliance advances. The advancing alliance is the first one to win two matches. Any tied matches will be replayed until one alliance has two wins, and advances. The winners of each of

the Elimination Matches continue to play until the champion is determined. An example tournament bracket appears here:

During each round of the elimination matches, two teams from an alliance will compete on the playing field. If the alliance has three teams on it, the team that sits out the first match in an elimination series must play in the second match, with no exceptions. If the teams play more than two matches in any round, any combination of two alliance robots may be used. 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 will be recorded as a loss. Prior to each elimination match, the alliance captain must let the referee know which two teams will be playing in the upcoming match.

3.6.9 – AWARDS AND CLOSING CEREMONY

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

Depending on whether the event is a scrimmage, a qualifying tournament, or a championship, the tournament officials will determine the advancement criteria. Generally, the Inspire Award winner and the Winning Alliance Captain will advance to the next round of competitions. Other teams may be chosen to advance to the next round. The advancement criteria will be announced to the teams prior to the start of the event.

3.7 – TOURNAMENT RULES

<T1> Referees have ultimate authority during the competition. **Their rulings are final.**

a. The referees will not review any recorded match replays.
b. Any questions for the referees must be brought forward by one student drive team member per team within the time period of two (2) matches following the disputed match.
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.
d. Individuals and Teams that violate this rule will be subject to possible team punishments including anywhere from match disqualification up to and including removal from the tournament.
e. Teams are encouraged to review all team rules including **<G13>** and **<G14>**.

<T2> The only team representatives permitted in the competition area are the three drive team members who are identified by the drive team badges. These badges are interchangeable within a team.

<T3> There are no time outs in the qualifying rounds. The matches must progress according to schedule.

a. 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 will be guaranteed a minimum of five minutes (5:00) between participating in consecutive matches.

<T5> In 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 will begin at the time of when their match was going to start.

<T6> All team members and their guests, including coaches, must wear 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 better/brighter 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.

3.8 – 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 stylizes itself with team T-shirts, trading buttons, hats, cheers, cheerleaders, and costumes.

3.8.1 – 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: Team Resources for information About *FIRST* and FTC logo use requirements.

3.8.2 – 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 and/or sponsor banners, but we ask that you adhere to the following:

- Do not use them to section off seating. Saving group seats is not permitted.
- Hang banners in your pit station only, not on the pit walls.

- You may bring banners to the competition area, but please do not hang them there. This area is designated for official *FIRST* sponsors' banners.

3.8.3 – SPECTATORS AND ETIQUETTE

Teams are permitted to have 2 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.

3.8.4 – SCOUTING

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

Teams use all different methods to record information about other teams – paper, computer, hand-held PDAs, 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 can't it do?
- STRATEGIES – what does the robot / team do during the match? How do they 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. Many teams use a paper system to record this information. Information on Capabilities can be obtained by visiting the team / robot in the pit area.

SECTION 4 - THE ROBOT

4.1 – OVERVIEW

This section provides rules and requirements for the design and construction of your robot. 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 *GET OVER IT!* Prior to competing at each event, all robots will have to pass an inspection. Refer to Section 9 for the Robot Inspection Guidelines and Inspection Checklists.

4.2 – ROBOT RULES

There are specific rules and limitations that apply to the design and construction of your robot. Please ensure that you are familiar with each of these robot rules before proceeding with robot design.

<R1> Only ONE robot will be allowed to compete per team in the *FIRST* Tech Challenge. Though it is expected that teams will make changes to their robot at the competition, a team is limited to only ONE robot.

a. It is against the intent of this rule to compete with one robot while a second is being modified or assembled.
b. It is against the intent of this rule to switch back and forth between multiple robots during a competition.

<R2> Every robot will be required to pass a full inspection before being cleared to compete. This inspection will ensure that all FTC robot rules and regulations are met. Initial inspections will take place during team registration/practice time.

a. If significant changes are made to a robot, it must be re-inspected before it will be allowed to compete.
b. All robot configurations must be inspected before being used in competition.
c. Teams may be requested to submit to random spot-inspections by event personnel. Refusal to submit will result in disqualification.
d. Referees or inspectors may decide that a robot is in violation of the rules. In this event, the team in violation will be disqualified and the robot will be barred from the playing field until it passes re-inspection.

For further information on the inspection process please refer to Section 9, Robot Inspection Guidelines

<R3> 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 other competing robots.
c. Those that contain hazardous materials (e.g. mercury switches).
d. Those that pose an unnecessary risk of entanglement.
e. Those that are designed to flip or tip over goals or other robots.
f. Those that contain sharp edges.

<R4> At the beginning of any match, the maximum allowed size of a robot is 18” x 18” x 18”.

a. During inspections, robots will be placed into a “sizing box” which has interior dimensions matching the above size constraints. To pass inspection, a robot must fit within the box as defined in the Robot Inspection Section.

b. Robots may expand beyond their starting size constraints after the start of a match.
c. 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.

<R5> Robot construction is constrained to the following:

a. Any part from the TETRIX system with the following constraints:
    1. No more than eight (8) TETRIX 12V DC drive Motors.
    2. No more than twelve (12) total combined TETRIX 180 Degree (HiTEC HS-475-HB) and Continuous Rotation (HiTEC HSR-1425CR) Servos in any combination.
    3. Exactly one (1) Samantha WiFi Communication Module with one USB A-B cable to go from the Samantha module to the NXT (24" or shorter is recommended) must be used.
    4. Exactly one (1) 12V Rechargeable NiMH Battery Pack. This battery pack may only be used to power the Samantha WiFi Communications module, the HiTechnic DC Motor Controllers, and the HiTechnic Servo Controllers. This battery pack must be identical to those supplied in the kit of parts. (Note: the TETRIX™ battery pack is custom designed with an internal 20 amp protection circuit. Use of any other battery could result in permanent damage to the NXT components and is not allowed). Battery packs are NOT allowed to be used as ballast.
    5. A total of no more than four (4) HiTechnic DC Motor or Servo Controllers (in any combination).
    6. The TETRIX R/C Controller (Product Id W34243), the Infrared Electronic Ball (Product Id W991458) and the TETRIX Speed Controller (Product Id W34244) are NOT allowed.
    7. The TETRIX AA Battery Holder is not allowed.
    8. The Permatex Super Lube provided by the TETRIX system may be used only to reduce friction with the Robot. Lubricants shall not be allowed to contaminate the playing field or other Robots.
b. Any LEGO building element with the following constraints:
    1. Exactly one (1) NXT Controller must be used.
    2. The NXT controller must be powered either by the NXT rechargeable AC battery (W979798), NXT DC Battery (W979693), or six (6) AA batteries.
    3. No more than three (3) NXT Motors may be used.
    4. Non-NXT electrical elements are not allowed, with the exception of RCX sensors.
    5. LEGO pneumatic elements are allowed. Teams may not modify LEGO pneumatic elements to attempt to change the working pressure limits of the elements.
    6. Any LEGO Approved NXT sensor (as indicated by the LEGO Mindstorms NXT Certified – Hardware label).
    7. Any NXT compatible sensor from HiTechnic, including the NXT Touch Sensor Multiplexer, NXT Sensor Multiplexer and the NXT prototype boards (both solderable and solderless).
    8. No more than one (1) HiTechnic 9-volt Battery Box that is sold as part of the NXT Sensor Multiplexer set may be used. It may be used only in conjunction with and to power the NXT Sensor Multiplexer(s).

9. LEGO-Approved NXT extension cables. Approved cables are currently only available from LEGO and HiTechnic.
10. LEGO Duplo products are not allowed.

c. The following additional components may also be used:

1. Polycarbonate plastic sheet (e.g. Lexan), not to exceed 576 sq. inches total area (regardless of thickness), 24" maximum dimension and not greater than 0.125” thick (Ex: McMaster-Carr Part # 8574K53 – also available at Home Depot and Lowe’s).
2. Kydex plastic sheet, not to exceed 576 sq. inches total area (regardless of thickness), 24" maximum dimension and not greater than 0.125” thick (Ex: McMaster-Carr Part # 8650K12).
3. ABS plastic sheet, not to exceed 576 sq. inches total area (regardless of thickness), 24" maximum dimension and not greater than 0.125” thick (Ex: McMaster-Carr Part # 8586K461).
4. PETG sheet (aka Vivak® Copolyester Sheet) not to exceed 576 sq. inches total area (regardless of thickness), 24" maximum dimension and not greater than 0.125” thick (Ex: McMaster-Carr Part # 85815K35).
5. Polycarbonate glue/cement is allowed, only for the joining of polycarbonate pieces. Use of polycarbonate glues/cements may or may not be allowed in the pits at tournaments based on site-specific rules or requirements.
6. Aluminum sheet, not to exceed 576 sq. inches total area (regardless of thickness), 24" maximum dimension and not greater than 0.0625” thick (Ex: McMaster-Carr Part # 89015K41 or 88685K53).
7. Aluminum 90-degree angle, up to 1” x 1” wide, 0.0625” thickness. Total length regardless of leg dimensions shall not exceed 36” (Ex: McMaster-Carr Part # 4630T15).
8. Aluminum U-channel, up to 1” x 1” wide, 0.0625” thickness. Total length regardless of leg dimensions shall not exceed 36” (Ex: McMaster-Carr Part # 4592T31).
9. Aluminum square tube, up to 1” x 1” wide, 0.0625” thickness. Total length regardless of leg dimensions shall not exceed 36” (Ex: McMaster-Carr Part #88875K513).
10. Aluminum flat [bar], up to 1” wide, 0.0625” thickness. Total length regardless of leg dimensions shall not exceed 36” (Ex: McMaster-Carr Part # 8975K823).
11. Any quantity of aluminum or nylon/plastic Pop Rivets (also known as Blind Rivets) that are designed to be installed using a hand pop-rivet gun. They rivet must be aluminum, nylon, or plastic, but the mandrel can be made of any material. Size not to exceed 0.25” diameter and 0.50” length (Ex: McMaster-Carr Part # 97447A651 or Home Depot SKU # PAA54 - 5B).
12. Rope or cord made from non-metallic materials such as nylon, polypropylene, hemp, cotton, sisal, etc. of any length, not to exceed 0.125” in diameter.
13. Plastic-coated wire rope with a bare wire diameter of 0.03125” or smaller. Compatible compression sleeves, clamps and hardware may also be used only in conjunction with the plastic-coated wire rope.
14. Non-Slip Pad, not to exceed 576 sq. inches total area, 24" maximum dimension (e.g. McMaster Carr Part #69275T54 or Home Depot SKU #134555).

15. 3” or smaller PVC or CPVC flexible or rigid piping (of any schedule), not to exceed 36” in total length (regardless of PVC size). Schedule 40 3” PVC has a nominal inside diameter of 3.068”and is allowed.
16. Commercial PVC couplings (i.e. Tee’s, elbows, couplings, caps, etc.) are not allowed.
17. PVC cement and cleaner (only for gluing PVC). Use of PVC cements and cleaners may or may not be allowed in the pits at tournaments based on site-specific rules or requirements.
18. Compatible mechanical fasteners (nuts, bolts, screws, washers, etc.) of any length. The intent of this rule is to allow teams to use fasteners from any supplier that are substantially the same as TETRIX fasteners. Compatible fasteners are characterized by using the same thread characteristics as TETRIX fasteners. For example, an acceptable substitute for the TETRIX 6-32 thread, 1/2" length socket head cap screw is a 6-32 thread, 3/4" length, button head cap screw purchased at a local hardware store.
19. Mechanical fasteners may be secured using Loctite® or a similar thread-locking product.
20. Any number of Rubber bands size #32 or smaller, (i.e. 0.125” thick & 3” in circumference).
21. Surgical Tubing 0.375" OD or smaller not to exceed 24” total length (Ex: McMaster-Carr Part # 5234K45).
22. Electrical tape and/or heat shrink tubing used only for insulation of electrical connections.
23. Universal Security Clips to hold PWM connections together, such as #2870 found at http://www.maxxprod.com/mpi/mpi-3.html.
24. PWM extension cables. These cables may either be purchased from a vendor or fabricated by the team.
25. Any material strictly used as a color filter for a Light Sensor.
26. Hook and loop (e.g. Velcro, 3M Dual Lock) fastener may be used. The fastener may not be used as tape (i.e. the adhesive side may not be used to join together robot parts).
27. Non-Metallic Cable ties (also known as Zip Ties) up to 11” in pre-cut length may be used.
28. Custom-made brackets for securing the encoder to the 12V DC drive motors are allowed providing they are used only for that purpose.
29. #25 chain off-set half links.(McMaster-Carr part# 6261K105 or AndyMark part# am-0682).
30. The packaging, manual binders, Styrofoam, cardboard, plastic bags, etc. from the TETRIX and/or LEGO kits are NOT included and CANNOT be used for robot construction. Only the TETRIX and LEGO® parts themselves are allowed.

d. For the HiTechnic NXT Prototype Board the following constraints apply:
    1. All power used in the circuits connected to the NXT Prototype Board must be derived from the power connections provided within the board. No batteries or external power sources are allowed.

2. Circuits may connect only to the named connections provided by the NXT Prototype Board (i.e. A4-A0, B5-B0, 3V, 4V, 9V, 5V, GND).
3. Communication to the NXT Controller may only occur through the included NXT connector.
4. Sensors connected via the NXT Prototype Board may be distributed throughout the Robot, they do not need to be physically attached to the NXT Prototype Board.
5. Additional circuit boards may be connected to the NXT Prototype Board as needed.
6. The processor included in the NXT Prototype Board may not be reprogrammed.
7. Circuits included as part of the HiTechnic NXT Prototype Board may not cause interference with any robot on the playing field, any part of the field management system or any game element.
8. Only visible light LEDs may be connected to the Prototype Board. These visible LEDs may only be used as a cueing signal for the team or for decoration. If used, the purpose must be demonstrated during inspection.

e. The Robot must be designed to be controlled by no more than two (2) Logitech Gaming Controllers.
f. Teams may add non-functional decorations from parts not on the above list, provided that these parts are non-functional, do not require external power except as specified in rule <R5>d, do not affect the outcome of the match, are not hazardous to themselves or other teams, and are in the spirit of Gracious Professionalism.
g. Vex parts of any type are not allowed.
h. No additional components may be used.

<R6> All parts listed in <R5>c and that are used must be tracked through a Bill of Materials (BOM). **This list *MUST* be submitted at inspection and a copy can be included in your Engineering Notebook.**

a. Detailed cut patterns of the plastic and aluminum sheets MUST be included with the BOM if the material is used on your robot.
a. A sample BOM and cut sheet is included in Section 9 – Robot Inspection.

<R7> During inspections if there is a question about whether something is an official TETRIX or LEGO component, a team will be required to provide documentation to an inspector, which proves the component's source. Such types of documentation include receipts, part numbers, or other printed documentation.

<R8> Each team MUST "name" their NXT with their official FTC Team number expanded to four digits with leading zeros (e.g. FTC Team #123 would name their NXT "0123" without quotation marks). Should you come to the tournament with a spare NXT, then you should name that spare with your team number followed by a hyphen then a letter designation beginning with "B" (e.g. "0123-B", "0123-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 FCS that it is a spare.

<R9> Teams MUST install the Samostat system support program onto their NXTs for the competition. The program files are installed when the team installs the Samanatha Field Control System (FCS) onto their computer. The Samostat programs must be compiled with the appropriate software (either ROBOTC or LabView) as chosen by the team. Once installed, the team does not have to install it again unless a new version of the Samostat code or the programming environment is updated.

<R10> Teams MUST install the Program Chooser onto their NXTs for the competition. These programs must be compiled with the appropriate software (either ROBOTC or LabView) as chosen by the team. Once installed, the team does not have to install it again unless a new version of the Program Chooser code or the programming environment is updated.

<R11> Part modification:

a. TETRIX and LEGO structural parts may be cut, sanded, filed, bent, drilled, milled, etc.
b. Motors, sensors, controllers, battery packs, and any other electrical components may NOT be altered from their original state in ANY way.
c. Motor power, power and encoder wires may be extended by splicing additional lengths of wire:
    1. Motor wires are 22 AWG or larger
    2. Battery wires are 16 AWG or larger
    3. PWM wires are 20 AWG or 22 AWG
d. Welding, soldering (except as listed below), brazing, gluing, melting or attaching in any way that is not provided within the TETRIX System will NOT be allowed.
e. Soldering is allowed only:
    1. As needed for electrical connections on the HiTechnic NXT Sensor Proto Board
    2. As needed for splicing wires (all splices should be insulated with electrical tape or heat-shrink tubing)
    3. As needed for 12V DC Motor connections
    4. As needed for tinning ends of replacement power wires
    5. Soldering may or may not be allowed in the pits at tournaments based on site-specific rules and requirements.

<R12> Robots MUST display their team number (numerals only, e.g. “106”).

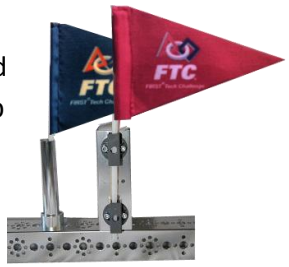
a. The judges, referees, and announcers must be able to easily identify robots by team number.
b. Team number must be visible from at least two sides of the robot (180 degrees apart).
c. Team numbers must be robust enough to withstand the rigors of match play.
d. The numerals must each be at least three inches high, at least in 0.5” stroke width and in a contrasting color from their background.

e. Team numbers and their mounting surface are NOT required to be made of allowed materials 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.
f. Numbers can be attached to the robot with tape or hook and loop fasteners (i.e. Velcro) so long as the only use is to adhere the numbers to the robot and not to join robot parts.

<R13> The NXT controller and Samantha WiFi Communication Module MUST be accessible and visible by competition personnel including inspectors, referees, and field control operators.

a. The NXT battery must be easily removed with minimal disassembly of the robot.
b. The USB ports on the NXT and Samantha WiFi Communication Module must be easily accessible.
c. The NXT Controller LCD display and Samantha WiFi Communication Module LED's MUST be readily visible.
d. The NXT Controller and Samantha WiFi Communication Module buttons must be readily accessible.

<R14> Robots MUST include a mounting device to securely hold one FTC Robot 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.



a. The flags will be provided at the event
b. Flag tubes are typically a soda straw with dimensions that are close to 0.250" OD x 0.200" ID x 8.250" length with a triangular flag 4.000" high x 6.000" wide. These may vary from event to event.

<R15> Robot TETRIX power switch MUST be mounted/positioned to be readily accessible and visible to competition personnel. The power switch must be installed according to the TETRIX system documentation (i.e. between the battery and the first HiTechnic DC Motor or Servo Controller)

<R16> 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 2.03 or later (firmware version 7.98 or later)
b. LabVIEW Education Edition 2009 SP1 (FTC Software 2011) (NXT Firmware version 1.28 or later)

Templates for all programming choices are available at http://www.usfirst.org/ftc. If updates are announced later in the season, teams must update to the latest version prior to time of competition.

<R17> 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 12V battery, HiTechnic 9-volt Battery Box, or the NXT batteries.
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.

<R18> Game elements launched by Robots should not be launched with velocity greater than that required to reach a maximum of four (4) feet above the playing field surface, nor travel a horizontal distance greater than ten (10) feet.

<R19> 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 Tele-Op mode correctly using the latest version of the FCS.

<R20> Teams may create a custom Icon that will be displayed on a monitor during match play. Team Icon designs are required to be in the spirit of Gracious Professionalism (i.e. suitable for family viewing, not offensive, etc.) Instructions for creating a Team Icon are in the Samantha WiFi Communication Module documentation.

SECTION 5 – ENGINEERING NOTEBOOKS

5.1 – OVERVIEW

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

5.2 – WHAT IS AN ENGINEERING NOTEBOOK?

One of the goals of *FIRST* and the *FIRST* Tech Challenge 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 some 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 will follow your team from kickoff throughout the competitions. Judges will review your Engineering Notebook to better understand your journey, design, and team.

Note: Refer to the judging criteria section of Section 7: Awards & Judging Criteria for more details on how your Engineering Notebook will be judged.

5.3 – THE NOTEBOOK

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". All pages must be numbered and in order. Only one copy is required per team. Online videos or demonstrations cannot be considered this year.

Written: Spiral-bound, Laboratory, or documentation notebooks are available through your school or local stationary supply store. There are many different types to choose from, using the following criteria:

1. Do not use a loose-leaf notebook.
2. Numbered pages are recommended (but not necessary) so that pages cannot be substituted or deleted.
3. Only one Engineering Notebook will be required per team.

Note: FTC Program Sponsor, Rockwell Collins has provided spiral bound notebooks for each team. Notebooks are provided with each kit of parts, or software upgrade package. It is not required that teams use these notebooks, provided the one they choose complies with the criteria outlined above.

5.4 – GUIDELINES/FORMAT

The *FIRST* Tech Challenge Engineering Notebook is a complete documentation of your team's robot design. This documentation should include sketches, discussions and team meetings, design evolution, processes, the "Aha's!", obstacles, and each team member's thoughts throughout the journey for the entire season. A new notebook should be created for each new season. So here are the guidelines:

1. Document EVERYTHING!!
2. Engineering Notebooks should be organized enough to have an outsider understand your team and your journey.
3. Written entries should be in Permanent Ink – Not Pencil.
4. Start 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 *FIRST* Tech Challenge team.

   Tip: Pictures along with the bios would serve as a great visual for the judges to get to know each member of your team.

5. Start a fresh page at every meeting. Your team number, date, and start/stop times should be recorded when starting a new page. Each day should start with two columns:
   a. Task Column – What your team is doing and discovering?

   b. Reflections Column – Where your team records thoughts on what is happening and any questions that need to be answered.
6. Entries should be made by every team member, initialed, and dated.
7. All designs and changes to your robot should be recorded directly into your notebook. The inclusion of all elaborate details and sketches are preferable. Notes and calculations should be done in your notebook, NOT on loose paper.

   Tip: 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 will not be viewed as highly.

8. 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.
9. Use both sides of a page. Never leave any white space: "X" out or Crosshatch all unused space, and don't forget to initial and date.
10. 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.

    Tip: Pictures or sketches of your robot designs are recommended as part of a thorough documentation.

11. Insert a copy of your Robot's Bill of Materials (BOM) as part of your Engineering Notebook as required by rules elsewhere in this manual.
12. The Engineering Notebook is also a good place to discuss and show team activities that are done throughout the team's season. These activities can be placed in a separate section of the Engineering Notebook or chronologically within the design pages.
13. Don't forget to put your team number in your Engineering Notebook and on your cover, so we know who to return it to after the judges have seen it!

5.5 – JUDGE'S TIPS

1. Every notebook is a work in progress, forever changing and developing. Judges do not want to see a "final" copy notebook; they want the real thing complete with misspellings, stains, worn edges and wrinkled pages. Just remember to keep it real!
2. When turning notebooks into the judges at your event, place sticky tabs at the top of the page on your top 6-12 best moments as a team. Judges will use these pages as their preliminary review of your notebook.
3. Don't be afraid to customize your Engineering Notebook to reflect your team's personality! At the end of the season, this notebook will be a great piece of memorabilia for your team.

5.6 – VIRTUAL HELP

It is in the spirit of *FIRST* to bring the technical knowledge of an engineer to high school students to broaden their awareness and knowledge of the engineering world. Please ask any questions you have about the Engineering Notebook in the Official FTC Q&A system.

5.7 – NOTEBOOK EXAMPLES

Scanned copies of award-winning Engineering Notebook examples are posted on the *FIRST* Tech Challenge 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.

SECTION 6 – FIELD CONTROL SYSTEM

6.1 – OVERVIEW

This section provides a general summary regarding the Field Control System (FCS). The FCS is the software program which will be loaded on each team's computer for the purpose of running autonomous and driver control modes by teams to test their robots and programming. This program is a very important part of the competition and members of the team need to understand how the program is used throughout the build season and during the events.

The same FCS program will also be used in competition, however as a master control program for the four robots on the field. The FCS will a) control the time of the match; b) start and end the autonomous and driver-controlled portions of the match; and c) enable and disable robots on the field.

6.3 – FUNCTIONS PERFORMED BY THE FCS

The FMS will perform the following functions for teams in the *FIRST* Tech Challenge:

6.3.1 – ROBOT PAIRING AND FIELD CONNECTION

The FCS will allow the connection for the robots and will display the status of each of the connected Logitech Dual Action Gamepads. It will also perform the WiFi pairing process with the NXT and remember the connection to speed up the pairing process between matches. It will read the NXT to determine the name of the program that is to be used during the Driver Controlled portion of the match and display the name of that program on its display.

During match play, there will be controls in the FCS to disable the robot, reconnect the Gamepads (should connection be lost), and reconnect to the NXT (should connection be lost).

6.3.2 – ROBOT DEVELOPMENT CONTROL

The FCS is designed to be used by teams during their development process as well and to give them a feel of the program that will be used during the tournaments. There will be a place to input the name of the NXT being connected to confirm your connection and there will be indicators on the display to show the status of the connection between the computer and the NXT, the Gamepad controllers, and show whether the Autonomous program or the Operator Control program is running on the NXT. The FCS will insure that the Gamepad controllers are disabled during Autonomous time.

6.3.3 – TEAM MATCH CONTROL

For matches, the FCS will provide input fields for the control of the time of Autonomous and Driver Controlled modes in minutes/seconds. There will also be check boxes to select whether there will be an Autonomous or Driver Controlled mode and whether to Pause between modes. There will be controls to Start, Stop, and Continue (after the optional Pause) the timer and messages to the NXT. There will be a digital timer display for seeing the competition match times. The FCS will also play the match sounds (Start of Match, Pause between modes, End Game indication, and End of Match) from your computer.

6.4 – HOW TO USE THE FCS

All documentation for the Samantha FCS program including how to set it up for competitions as well as individual team testing is located on the *FIRST* Tech Challenge website.

SECTION 7 – JUDGING & AWARDS CRITERIA

7.1 – OVERVIEW

This chapter provides a complete description of all of the *FIRST* Tech Challenge Awards; the judging process, criteria and philosophy that teams will need to be aware of in preparation for participating at a *FIRST* Tech Challenge Tournament.

In addition to winning points during the regional competition, the awards represent another positive way for mentors to instill important values like teamwork, creativity, innovation, and the value of the engineering design processes. These judging guidelines are a part of the road map to success.

7.2 – *FIRST* TECH CHALLENGE AWARDS ELIGIBILITY

To ensure fairness to all teams and to provide equal opportunity for all teams to win an award at a *FIRST* Tech Challenge 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 multiple awards.

Teams have spent several weeks 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.

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.

7.2.1 - 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 will be responsible for finding a location, organizing the format for the day, and inviting other teams to participate.

7.2.2 - QUALIFIERS

Hosted and managed by FTC Affiliate Partners or Partner-appointed hosts. Qualifiers, sometimes called Regionals, follow the same judging guidelines and format of Championship tournaments, but with a bit more flexibility. Qualifiers are usually held prior to Championship tournaments in regions where there are a plethora of FTC teams. The FTC Affiliate Partner will help determine the advancement criteria as to which teams move on to the Championship Tournament based on their performance at a Qualifier. The number of teams advancing to the state championship depends on the capacity of the state championship, the number of qualifying competitions and the number of teams attending the qualifying competition. Generally, the winner of the Inspire Award and the Winning Alliance will advance.

7.2.3 - 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 or regional tournament in order to advance to the Championship. Championships may include teams from a geographic region, province, state, country, or several countries. In past seasons, the winner of the Inspire Award and the Captain of the Winning Alliance at each Championship event received an automatic invitation to the FTC World Championship Event. Advancement eligibility for the World Championship will be announced after this season's kickoff.

7.3 – *FIRST* TECH CHALLENGE AWARD CATEGORIES

7.3.1 – *FIRST* TECH CHALLENGE 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' *FIRST* Tech Challenge 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 understands how to communicate their experiences and knowledge to other teams, sponsors, and the judges.

In past seasons, the winner of the Inspire Award at each Championship event received an automatic invitation to the FTC World Championship Event.

Once a team has won this award at a Championship, they are no longer eligible to win the Inspire Award at additional championship tournaments they may attend.

Guidelines for the Inspire Award

- Team must demonstrate respect and Gracious Professionalism both for team members and fellow teams
- Engineering Notebook must be submitted, and must impress the judges
- Team must work beyond their robot to help spread awareness of the team within the community
- Team displays good communication and teamwork skills within the team as well as with their alliances
- Team communicates clearly about their robot design to the judges
- Team presents themselves well in the judges interview
- Robot effectively competes in the game challenge and impresses the judges
- Team and Robot consistently performs well during matches
- Team is a strong contender for all other judged awards

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 *FIRST* Tech Challenge 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.

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

7.3.3 – *FIRST* TECH CHALLENGE 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 compliment its purpose. This award is sponsored by Parametric Technology Corporation (PTC), developers of the CAD tools, Pro/ENGINEER 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 Design Award

- Team must submit an Engineering Notebook with detailed robot design drawings
- Robot differentiates itself from others
- Design is both aesthetic and functional
- Well thought out basis for the design (why i.e. inspiration, function, etc.)
- Special consideration is given to teams who use PTC CAD products in the design of their robot.

7.3.4 – *FIRST* TECH CHALLENGE 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 their schools and communities play an essential part to their success. The recipient of this award is recognized for helping the community understand *FIRST*, the *FIRST* Tech Challenge, 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 fundraising goal and plan to achieve that goal.

Guidelines for the Connect Award

- 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 plan or other way of determining their fundraising needs and a plan to achieve their fundraising goal
- Team has a plan to give back to their community

7.3.5 – *FIRST* TECH CHALLENGE MOTIVATE AWARD

This judged award celebrates the team that exemplifies the essence of the *FIRST* Tech Challenge competition through team spirit and enthusiasm. They show their spirit through costumes and fun outfits, a team cheer or 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 spirit is consistent throughout the team and the competition.
- Team is enthusiastic
- The team functions well as a team
- Team enthusiasm is evident in their community outreach

7.3.6 – *FIRST* TECH CHALLENGE 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 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 steps, brainstorms, designs, re-designs, successes, and those 'interesting moments' when things weren't going as planned. A team will not be a candidate for this award if they have not completed the section of the Engineering Notebook describing the team's experience.

Guidelines for the Think Award

- Team must submit an Engineering Notebook
- 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*
- Collaboration and co-ownership are dominant themes in the Engineering Notebook or in the judges interview

Note: Teams should review Section 5: Engineering Notebooks for a complete description and format specifications.

7.3.7 – *FIRST* TECH CHALLENGE WINNING ALLIANCE AWARD

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

7.3.8 – *FIRST* TECH CHALLENGE 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 *FIRST* Tech Challenge 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 will either receive this schedule prior to or during check-in at the competition.

7.4.1 – JUDGING PROCESS

At the *FIRST* Tech Challenge Championship Tournament events, there will be three parts to the judging process: 1) interview with judges, 2) evaluation of performance, and 3) evaluation of the Engineering Notebook. Each team will have a "fact finding" discussion/interview with a panel of two or three judges. No awards will be determined on the basis of this interview alone. Judges will 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 but may be directed otherwise by the tournament officials. The Engineering Notebooks will be 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 performances during matches, they will 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 will be 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 will take place in a separate area(s) away from the noise of the competition and pit. Teams will 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 budget enough time to get there. To keep this process on time throughout the event, we require that all teams arrive at an adjacent queuing area five minutes before their scheduled interview.

7.4.3 – TEAM PREPARATION

Teams are encouraged to use the award guidelines to self assess where they are within an award category and help them establish higher goals. These guidelines will be the same ones used by the judges during each *FIRST* Tech Challenge event, and at the *FIRST* Tech Challenge World Championship.

Remember, this is the team's opportunity to highlight how they rallied as a team around the robot; the technical knowledge they gained along the way; and how this experience has affected the members and mentors individually and as a team. Judges will want to hear from team member representatives. Since there are several awards with different criteria, teams may want to consider appointing different team members to speak with judges on the specific topics. Mentors (no more than two) are welcome to observe the Judge's Interview, but may NOT participate during the judge's interviews.

7.5 – *FIRST* TECH CHALLENGE 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 *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.

For this season, *FIRST* Tech Challenge teams will need to earn their way to the FTC World Championship. Eligibility is earned by your performance on and off the field. The criteria for eligibility to the event will be announced later in the season. Teams will still be responsible for their own entry fees, lodging, and travel costs to the FTC World Championship.

SECTION 8 – TEAM RESOURCES

8.1 – OVERVIEW

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

8.2 – *FIRST* CONTACT INFORMATION

You can reach the *FIRST* Tech Challenge staff by phone at (603) 666-3906 or 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 in your message and leave contact information. Refer to the information below for the appropriate resource.

8.3 – GETTING ANSWERS TO YOUR QUESTIONS

For general information and questions regarding the *FIRST* Tech Challenge, 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/regionalcontact.aspx

For questions regarding the *FIRST* Tech Challenge *GET OVER IT!* game, 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 with the *FIRST* Tech Challenge.

** Please note that accounts are updated weekly by our IT Department. If you have trouble accessing the forums, please feel free to contact *FIRST* at the information above.**

The free forum account needs to be registered and activated in order to ask official game questions. The FTC Interactive Manual and Game Q&A is accessed directly at http://forums.usfirst.org/forumdisplay.php?f=26 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. Anybody can read this moderated forum. But only a single team leader should be the one that asks questions on the forum. Please make sure the question hasn't been asked before posting. Game questions will not be answered after 5:00 PM ET on Thursday during the competition season. These will be answered after the events have concluded for that weekend. As the forum is moderated, questions and answers will be posted after they have been reviewed and answered.

For detailed information on the *FIRST* Tech Challenge program, robot kit and accessories, playing field, etc., visit the following websites:

Website	Description
www.usfirst.org/community/FTC/default.aspx?id=968	FTC information, FAQs, and team resources
http://ftcforum.usfirst.org/forum.php	FTC Game Q&A and Samantha Forum
http://www.usfirst.org/roboticsprograms/ftc/game	FTC Game Information and links to other resources
http://www.usfirst.org/ftc/samantha	Samantha Information Resources

8.4 – 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.

8.5 – 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 you create a "buzz" about your team in your community.

You have incredibly creative opportunities in terms of designing your own identity. There are many examples of how teams "brand" their efforts with websites, incredible 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 *FIRST* Tech Challenge 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 circle, square, and triangle 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.

SECTION 9 – ROBOT INSPECTION

9.1 – OVERVIEW

This section describes Robot Inspection for the *FIRST* Tech Challenge 2010-2011 competition, *GET OVER IT!* It also lists the inspection definitions and inspection rules.

9.2 – 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 registration/practice time. A copy of the official FTC "Robot Inspection Checklists" is located in this section. It is STRONGLY RECOMMENDED that these Checklists be used by the teams as a guide to pre-inspect the robot prior to arriving at the event.

9.3 – 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 this year's competition. The robot may only be constructed from materials and components outlined in Section 4.2.

Robot Initialization Routine – A set of programming instructions inserted immediately prior to the match control loop of the Autonomous Mode program 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 9.4.

9.4 – 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 being allowed to compete 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 FTC Official Team Number must be displayed on the robot prior to inspection as defined in Section 4.2 <R12>.

<I4> Robot construction is constrained by the number of Official FTC Competition components a team may use as defined in Section 4.2<R5>. There is not a specified FTC robot weight constraint.

<I5> 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 as follows:

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

e. by mechanical means with the robot in a power-OFF condition
f. 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. If the Robot Initialization Routine does move the servos prior to the official start of the match,

there must be an indicator on the robot of this fact. A warning label such as the following will suffice:

<I6> All robots placed on the field will maintain the size constraints outlined in **<I5>** until the beginning of match play.

<I7> When an FTC team makes a modification to improve performance or reliability of their robot, the team may request a re-inspection of their robot by an FTC Inspector.

<I8> It is the FTC Inspectors responsibility to evaluate robots to insure each robot has been designed to operate and function safely. Section 2.4.3 **<S1>** and Section 4 specify the safety rules and limitations that apply to the design and construction of all robots.

<I9> 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.

HARDWARE INSPECTION CHECKLIST

Team Number: _____ Overall Status (circle): **PASS / FAIL**

Inspection Start Time: _____ Inspection End Time: _____

Inspection Type: ____ Initial ____ Mandated ____Random

	Size Inspection	
	Robot fits within the Sizing Box (18" x 18" x 18") without exerting force on box sides or top	R4a
	Overall Inspection	
	Team Number is visible from at least 2 sides, is written in 3" tall, 1/2" stroke on a contrasting background	R12
	Robot does NOT contain any components which will be intentionally detached on the playing field	G7
	Robot does NOT contain any components that could damage the playing field or other robots	R3
	Robot does NOT contain any sharp edges or corners	R3
	Robot poses NO obvious unnecessary risk of entanglement	R3
	NXT battery can be easily removed without disassembly	R13a
	USB ports (NXT and Samantha) are easily accessible for rapid registration	R13b
	NXT Controller LCD display and Samantha LEDs display are readily visible	R13c
	NXT Controller and Samantha Module readily accessible	R13d
	Robot Flag Holder is present and adequately holds the flag during normal robot operation	R14
	TETRIX Power Switch is positioned to be readily visible to competition personnel and installed properly	R15
	ALL Decorating Components on the Robot NOT meeting FTC Inspection Criteria are NON FUNCTIONAL	R5f
	Parts Inspection - Official TETRIX and LEGO Components	
	ALL Robot components are OFFICIAL TETRIX or LEGO Products	R5
	FTC Robot does not utilize any of the Packaging materials	R5c
	Robot has only one (1) NXT controller	R5b
	Robot uses maximum of three (3) NXT Motors	R5b
	Robot has only one (1) Samantha module	R5a
	Robot uses maximum of eight (8) 12V DC drive motors	R5a
	Robot uses a maximum of twelve (12) servos (HiTEC HS-475-HB or HiTEC HSR-1425CR)	R5a
	Robot uses a maximum of four (4) HiTechnic DC Motor or Servo Controllers (in any combination)	R5a
	Robot uses one (1) official NXT rechargeable battery pack (AC or DC) or six (6) AA batteries (not both)	R5b
	Robot uses one (1) official FTC 12 V DC NiMH battery	R5a
	(optional) Robot uses one (1) HiTechnic 9-volt Battery Box is used as part of the NXT Sensor Multiplexor	R5b
	Additional Parts Inspection	
	Robot contains no more than 24"x24"x0.125" thick polycarbonate	R5c
	Robot contains no more than 24"x24"x0.125" thick Kydex	R5c
	Robot contains no more than 24"x24"x0.125" thick ABS plastic	R5c
	Robot contains no more than 24"x24"x0.125" thick PETG	R5c
	Robot contains no more than 24"x24"x0.0625" thick aluminum	R5c
	Robot contains no more than 36” of 1”x1”x0.0625” thick aluminum 90-degree angle	R5c
	Robot contains no more than 36” of 1”x1”x0.0625” thick aluminum U-channel	R5c
	Robot contains no more than 36” of 1”x1”x0.0625” thick aluminum Square Tube	R5c
	Robot contains no more than 36” of 1”x0.0625” thick aluminum Flat Bar	R5c
	Robot contains any number of nylon/plastic or aluminum Pop Rivets not larger than 0.25” diameter and	R5c

	0.50” length	
	Robot contains rope or cord not thicker than 0.125” diameter	R5c
	Robot contains plastic coated wire rope not thicker than 0.03125” diameter	R5c
	Robot contains no more than 24"x24" of Non-Slip Pad	R5c
	Robot contains no more than 36” length of PVC piping not thicker than 3” inside diameter	R5c
	Robot contains any number of rubber bands not larger than #32 (0.125” thick & 3” in circumference)	R5c
	Robot contains no more than 24” length of surgical tubing 0.375" outside diameter or smaller	R5c
	Robot contains electrical tape or heat shrink tubing only if used as electrical insulation	R5c
	Robot contains any number of cable ties not to exceed 11” in length	R5c
	LEDs (if used) must be visible light and only used as a signaling device or for decoration	R5d
	Construction Inspection	
	NO electrical components have been modified from their original state except the HiTechnic Prototype Board	R11
	NO method of attachment NOT provided by the Tetrix except as specified as allowable the rules (i.e. PVC cement on PVC, etc.)	R5/R11
	If thread locker is used, it is used for securing screws & fasteners ONLY	R5c

Reason 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 2010-2011 *FIRST* Tech Challenge have been abided by.

_____ _____

Hardware Inspector Team Student Representative

SOFTWARE INSPECTION CHECKLIST

Team Number: _____ Overall Status (circle): **PASS / FAIL**

Inspection Start Time: _____ Inspection End Time: _____

Inspection Type: ____ Initial ____ Mandated ____Random

QUEUING AREA CHECKLIST:

	Drive Team Members Present	
	Coach	
	Driver1	
	Driver 2 (optional)	
	NXT Configuration	
	NXT named with 4 digit team number (optional hyphenated letter appended)	R8
	NXT Firmware Version (circle one) LabVIEW ROBOTC 1.28+ 7.98+	R16
	NXT Sleep Timer set at 30 or above (60 recommended)	
	Queuing Process	
	Team understands that no software changes are allowed in Queue Area.	
	Team understands that match schedule is only an estimate. Matches may start prior to scheduled time and it is the teams' responsibility to monitor schedule changes and show up when required.	
	Team knows where to receive game flags and where to return them after the match	
	Team knows about pre-loaded game elements and that elements that are not used will remain out of play for the duration of the match	

I certify that the robot and driver station equipment is in the proper software configuration.

Queuing Area Inspection Completed by: _____

FIELD INSPECTION CHECKLIST:

	Field Setup
	Connection with tournament-supplied FCS successful
	Robot Setup on field understood and successful
	Robot Functionality
	(optional) Team successfully started the robots autonomous mode
	Robot did not move between autonomous and tele-op periods
	Team successfully started the robots tele-op mode
	Robot stopped at end of Tele-Op period
	Match Process
	Team understands how to call for FTA assistance during a match
	Team understands they cannot touch any robot or field element after the match until instructed to do so by the referees
	Teams understand they are to clear the field 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 expected during a match.

Field Inspection Completed by: _____

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

_____

_____

_____

_____

_____

_____

Team Student Representative _____

SAMPLE BILL OF MATERIALS FOR EXTRA PARTS

2010-2011 FIRST Tech Challenge Extra Parts Bill of Materials

Team Number _____ Team Name _____

Material	Original Width or Diameter	Original Length	Used Width or Diameter	Used Length	Total Sq Inches	Must not exceed
Plastics						
Polycarbonate (Lexan)						576 sq in
Kydex						576 sq in
ABS						576 sq in
PETG						576 sq in
Aluminum						
Sheet Aluminum						576 sq in
U-Channel						36 in
Square Tube						36 in
Flat Bar						36 in
90-degree Angle						36 in
Other components						
Non-slip Pad						576 sq in
Surgical Tubing (O.D. for diameter)						24 in
PVC Pipe (I.D. for diameter)						36 in

SAMPLE CUT SHEET