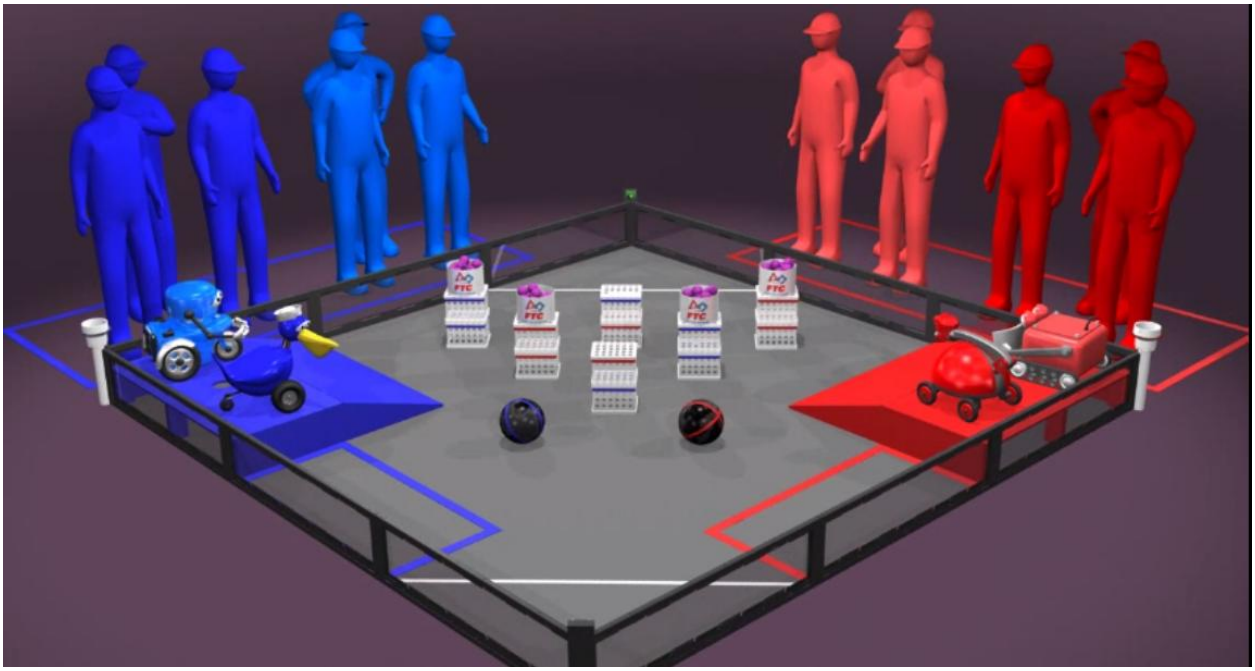
FIRST® Tech Challenge

BOWLED OVER!℠

2011 - 2012 OFFICIAL GAME MANUAL

Rev 5 - 2/28/2012



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REVISION HISTORY

Revision	Date	Description
1	9/10/2011	Initial Release
2	11/10/2011	Clarification on <SG6> (removed 'parked' from definition) Clarification on <SG7> (added 'or carried Crate' to definition)
3	11/22/2011	Clarification on <SG5> (clarification regarding contact with opposing Alliance's Ball Crate(s) Clarification on <SG13> (regarding scoring of Alliance-colored Bowling Ball prior to End Game)
4	11/28/2011	Clarification on <SG5> (clarification regarding contact with opposing Alliance's Ball Crate(s)) Clarification on <SG13> (regarding scoring of Alliance-colored Bowling Ball prior to End Game)
5	2/28/2012	New Addition <G16> under General Game Rules, regarding egregious robot or team behavior at the playing field. Clarification of advancement criteria.

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

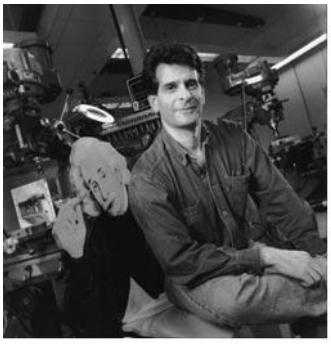
FIRST® (For Inspiration and Recognition of Science and Technology) was founded by inventor Dean Kamen to inspire young people's interest and participation in science and technology. Based in Manchester, New Hampshire, *FIRST* is a 501(c)(3) not-for-profit public charity.

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 (Jr.FLL®) for 6 to 9 year-olds. Also located at *FIRST* headquarters is the research and development facility called *FIRST* Place™. *FIRST* Place is integral to game design, new program development, evaluation, and professional development of *FIRST* mentors.

"We want to change the culture by celebrating the mind. We need to show kids that it's more fun to design and create a videogame than it is to play one."

Dean Kamen,
Founder, FIRST



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

**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 the *FIRST* Robotics Competition. Piloted for two years as the *FIRST* Vex Challenge, FTC became an official *FIRST* program and was renamed *FIRST* Tech Challenge in 2007.

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 a majority of the work, but the mentor is there to offer guidance, suggestions, and coaching to keep the students on task and successful. *FIRST* values are about appreciating our differences and learning what those differences add to our lives. *FIRST* programs succeed most fully when team members bring the *FIRST* values they learn back to their communities.

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

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

1.5 – THE *FIRST* TECH CHALLENGE – 2011-12 SEASON

FIRST Tech Challenge teams will participate in the *Bowled Over!* Challenge for the 2011-12 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 scoring racquetballs into stackable crates and moving bowling balls to different places on the field. Teams will be challenged by completing tasks during autonomous and driver-controlled periods and will be scoring special kinds of balls for extra points and pushing a bowling ball up a ramp 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. Students 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 and mentor *FIRST* LEGO League (FLL) Teams and Jr. FLL Teams in their area. They participate in fund raising and marketing events making the general public aware of their activity as well as inspiring 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* Championship Event in St. Louis, MO is an exciting event where teams from FTC, FRC, FLL and Jr. 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

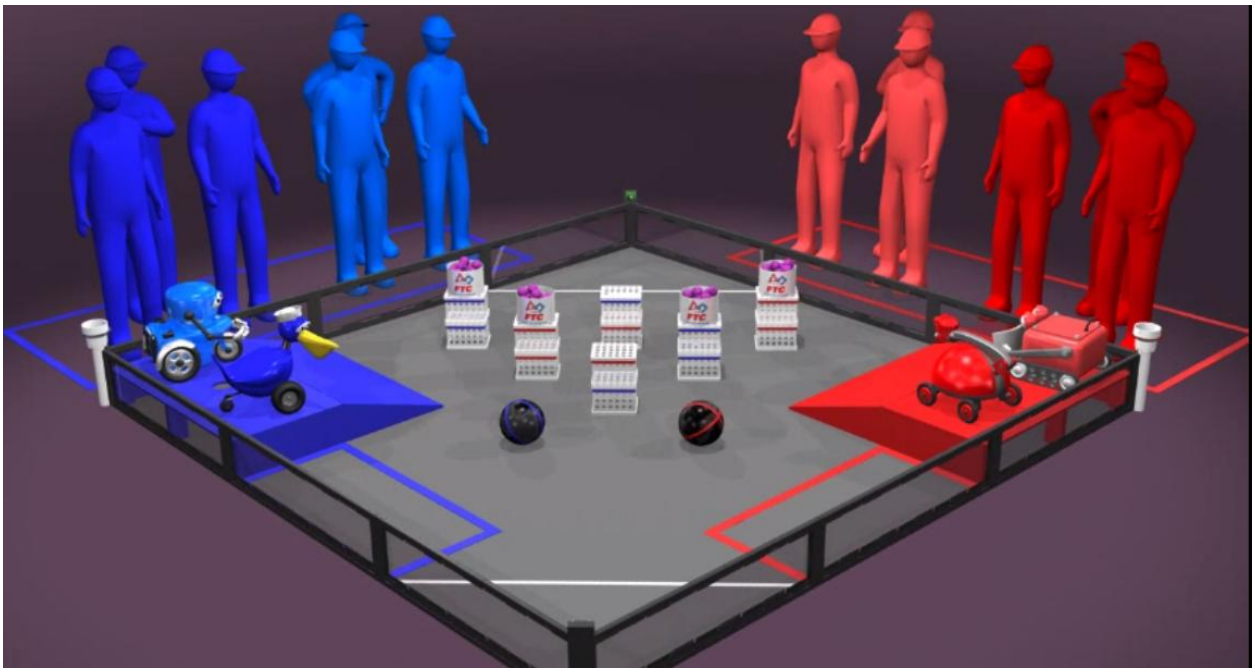
This section describes the *FIRST* Tech Challenge game for the 2011 season, called *Bowled Over!* It also lists the game definitions and game rules.

2.2 – GAME DESCRIPTION

Matches are played on a *Playing Field* initially set up as illustrated in the figure below. Two *Alliances* – one “red” and one “blue” – composed of two teams each, compete in each *Match*. The object of the game is to attain a higher score than your opposing *Alliance* by placing 2.25” (5.7cm) diameter racquetballs into several *Alliance*-colored scoring goals (*Ball Crates*, *Low Goals, and Off-Field Goals*) located on the *Playing Field*. The game is played in two distinct periods, *Autonomous* and *Driver-Controlled*

In the thirty (30) second *Autonomous Period*, teams are rewarded for driving to specific places on the *Playing Field* as well as setting upright *Alliance*-colored *Ball Crates* that will be used to collect balls during the rest of the game. Two *Bowling Balls* on the *Playing Field* will earn points for the *Alliance* depending on their location at the conclusion of the *Autonomous Period*.

The two-minute *Driver-Controlled Period* follows the *Autonomous Period*. Teams earn points for their *Alliance* by scoring racquetballs in a *Low Goal* or *Ball Crates*, and scoring special *Magnet Balls* in *Off-Field Goals*. Teams may also elevate stacks of Ball Crates to score more points. The final thirty (30) seconds of the *Driver-Controlled Period* is called the *End Game*. Each *Alliance* is challenged to push their *Bowling Ball* onto their *Home Zone* to score additional points.



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 exact details for field construction. Items listed in the full field BOM are recommended for an official Field. Suitable substitutions are acceptable. Lower cost field options are also provided at www.usfirst.org in the FTC Game Information section.

2.3 – GAME DEFINITIONS

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

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

Autonomous Period – A thirty (30) second period in which the *Robots* operate and react only to sensor inputs and to commands pre-programmed by the team onto the onboard *Robot* control system. Human control of the *Robot* is not permitted during this time.

Ball – One of the scoring elements for the 2011-12 FIRST *Tech* Challenge game, *Bowled Over!* The *Ball* is a 2.25" (5.7cm) diameter single-colored racquetball. There are two types of *Balls*: *Regular* and *Magnet*.

Regular Balls – These are ordinary single-colored racquetballs. There are 88 placed into the *Ball Tubes*.

Magnet Balls – These look like *Regular Balls*, however, they have a magnet hidden inside. There are twelve (12) of these *Balls* placed at random in the *Ball Tubes*.

Ball Crate – Scoring elements and containers for the game. There are six red and six blue *Ball Crates* that measure 9" x 7.875" x 6.125" (23cm x 20cm x 15.5cm). *Ball Crates* are in one of two states:

Inverted Crate – Starting position of the *Ball Crates* with the open-end down towards the floor.

Upright Crate – A legal scored position for a *Ball Crate* where at least one part of the bottom of the crate is in contact with the floor mat, platform, ramp, or with an element that is in contact with the floor mat, platform, or ramp.

Ball Tubes – A container that holds the *balls* at the start of the *Match*. There are four (4) *Ball Tubes* located on top of *Ball Crate* Stacks. *Ball Tubes* are not scoring targets or objects, but they can be used to raise *Ball Crates* to different elevations.

Bowling Ball – The *Bowling Ball* is a regular ten-pin ball with a maximum circumference of twenty-seven inches (27" / 68.6cm) and a weight of six (6) pounds (2.7kg). The *Bowling Ball* may be of any color and may or may not have finger holes in it. There are two, 1" (2.54cm) wide strips of colored tape (90 degrees apart) around the circumference of the *Bowling Ball* to signify *Alliance* color.

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.

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

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

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

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*.

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*.

Home Zone – The area of the field that incorporates the *Platform* and the *Ramp*, including the side panel. There are two *Home Zones* on the field – one Red and one Blue. The *Platform* is approximately 8" (20.3cm) high and measures 2' x 4' (61cm x 122cm). The *Ramp* measures 2' x 4' (61cm x 122cm) and is attached to the *Platform* leading down onto the *Playing Field*. Each *Platform* and *Ramp* is painted the color of the *Alliance* to which it belongs. In the center of the *Platform* is the *Home Zone Goal* for scoring the *Bowling Ball* during the *End Game*.

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

Parked / Completely Parked – An object (*Robot* or game element) is *Parked* if it is stationary and has broken the plane of the outside edge of the tape marking the *Scoring Area* or the boundary edge of the *Home Zone*. Being *Completely Parked* means that the entire scoring element or *Robot* must be within the *Scoring Area* defined by the outside edge of the tape marking the *Scoring Area* or the boundary edge of the *Home Zone*.

Parking Zones – The two triangular shaped areas located in the corners of the *Playing Field*. The *Parking Zones* are defined by 1" (2.54cm) white tape on the *Playing Field* surface. The *Back Parking Zone* is the corner area between the *Alliance Stations*. The *Front Parking Zone* is in the opposite corner of the field near the audience.

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

Pin / Pinning – Preventing the movement in all directions of an opposing *Robot* while in contact with the *Playing Field* boundary wall, one or more field elements, or another *Robot*.

Playing Field – The part of the *Competition Area* that includes the 12' x 12' (3.65m x 3.65m) field and all of the elements described in the official field drawings.

Protected Area – The area of the *Playing Field* that is outlined by the corresponding *Alliance's* color tape. There are two *Protected Areas* on the *Playing Field* – one red and one blue. *Robots* are not allowed to make contact with crates in the opposing *Alliance's Protected Area*. The *Protected Area* is also *a Low Goal* for scoring *Balls*. For the purposes of *Stacking*, the *Home Zone* is also considered part of the *Protected Area*.

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.

Scoring Areas – There are four (4) *Scoring Areas* where *Balls* or *Bowling Balls* may be scored – *Low Goals, Upright Ball Crates, Off-field Goals* and the *Home Zones*. *Balls* will be counted for the corresponding *Alliance* color of the goal.

Low Goal – Each *Alliance's Low Goal* is located on the *Playing Field* surface immediately to the side of the *Home Zone Platform* of each *Alliance*. The *Low Goal* is made up of an approximately 2' x 4' (61cm x 122cm) taped area within the *Playing Field* defined by the outside edge of the tape and includes the space extending infinitely above the region.

Upright Ball Crates – *Ball Crates* start on the field in the *Inverted* orientation and they become *Scoring Areas* when they are *uprighted* during game play.

Off-field Goals – There are two *Off-field Goals* (one per *Alliance*) located at the corners of the field border and the *Alliance Home Zones*. A *Magnet Ball* placed in an *Off-field Goal* will score for the corresponding *Alliance*. *Regular Balls* placed there will not score. If a *Regular Ball* causes the *Off-field Goal* to not register the lights while a *Magnet Ball* is also scored, the *Magnet Ball* will count. The *Scoring Area* of the *Off-field Goal* is defined by the boundary and extending infinitely above the goal. *Balls* scored in the *Off-field Goal* must be supported by the *Goal* or other *Balls* within the *Goal* and nothing else.

Home Zone – The area of the field that incorporates the *Platform* and the *Ramp*, including the side panel.

Home Zone Goal – A four-inch (10.16cm) diameter circle cut out on the *Home Zone Platform* used for scoring the *Alliance's Bowling Ball*.

Stacking / Process of Being Stacked – A *Ball Crate* is in the process of being *Stacked* if it is in contact with a *Robot* of the corresponding *Alliance* color, is completely off of the *Playing Field* and it breaks the projection of the vertical plane of a *Ball Crate* immediately below it.

Starting Location – The location where teams place their *Robots* before the start of the *Match*. The *Robot* may start in any orientation anywhere on top of the *Platform*, which is the *Starting Location* within the *Home Zone* for each *Alliance*.

Stacking Bonus – The bonus awarded to each *Alliance* based on the final location of the top-most portion of an *Upright Crate* that contains at least one scored *Ball*.

2.4 – GAME RULES

2.4.1 – SCORING IN THE AUTONOMOUS PERIOD

The following scores are recorded by the Referees at the end of the *Autonomous Period*:

1. *Uprighting* a *Ball Crate* is worth 5 points per crate based on the *Crate's Alliance* color. To be upright, any part of the bottom of the *Ball Crate* must be in contact with the *Playing Field* floor, platform, ramp, or with an element that is in contact with the floor mat, platform, or ramp.
2. *Parking* a *Robot* in the *Back Parking Zone* is worth 5 points. A portion of the *Robot* has to have broken the plane of the outside edge of the tape marking the *Parking Zone*.
3. *Parking* a *Robot* in the *Front Parking Zone* is worth 10 points. A portion of the *Robot* has to have broken the plane of the outside edge of the tape marking the *Parking Zone*.
4. A *Bowling Ball* that is *Parked* in the *Front Parking Zone* is worth 10 points for the matching color *Alliance*. For example, the blue *Bowling Ball* scores for the Blue *Alliance* regardless of the robot placing the *Bowling Ball* in the *Parking Zone*.
5. A *Bowling Ball* that is *Parked* in the *Back Parking Zone* is worth 20 points for the matching color *Alliance*. For example, the blue *Bowling Ball* scores for the Blue *Alliance* regardless of the robot placing the *Bowling Ball* in the *Parking Zone*.
6. No *score* is recorded for *Regular* or *Magnet Balls* in the *Autonomous Period*.

2.4.2 – SCORING IN THE DRIVER CONTROLLED PERIOD

The following scores are recorded by the Referees at the end of the *Match*.

1. A Regular or *Magnet Ball* that is *Parked* in the *Low Goal* is worth one (1) point for the corresponding *Alliance*. A portion of the *Ball* has to have broken the plane of the outside edge of the tape marking the *Low Goal*. A *Ball* will not count if it is in direct contact with a *Robot* of the corresponding *Alliance*.
2. A *Regular* or *Magnet Ball* that is scored in a *Ball Crate* is worth two (2) points for the corresponding *Alliance* based on the color of the *Ball Crate*. To be scored the *Ball* must be supported by the *Ball Crate* and be within a space formed by the extension of the inside surface of the *Ball Crate*. See Section 2.4.8 for pictures of scoring examples. A *Ball* will not count if it is in direct contact with a *Robot* of the corresponding *alliance*.
3. A *Regular Ball* that is scored in the *Off-field Goal* is worth zero (0) points.
4. *Magnet Balls* scored in the *Off-field Goal* are worth twenty-five (25) points each for the corresponding *Alliance*. To be scored the *Magnet Balls* must be supported by the *Off-field Goal* and be within a space

formed by the vertical extension of the inside surface of the *Off-field Goal*. Balls scored in the *Off-field Goal* must be supported by the *Goal* or other *Balls* within the *Goal* and nothing else.

5. *Stacking Bonus*: Unscored *Ball Crates* receive zero *Stacking Bonus* points. A *Ball Crate* must contain at least one *Ball* in a scoring position for the *Ball Crate* to earn a *Stacking Bonus*. *Stacking Bonus* points are assigned to **each Ball Crate** based on the height, **H**, of the highest point of that Ball Crate. See Section 2.4.9 for examples of Stacking Bonus scoring.

    a. $0 < H \leq 10.5$" (26.67cm) scores 0 points
    b. 10.5" (26.67cm) $< H \leq$ 16.5" (41.9cm) scores 10 points
    c. 16.5" (41.9cm) $< H \leq$ 22.5" (57.2cm) scores 20 points
    d. 22.5" (57.2cm) $< H \leq$ 28.5" (72.4cm) scores 30 points
    e. 28.5" (72.4cm) $< H \leq$ 34.5" (87.6cm) scores 40 points
    f. 34.5" (87.6cm) $< H \leq$ 40.5" (102.9cm) scores 50 points
    g. 40.5" (102.9cm) $< H \leq$ 46.5" (118.1cm) scores 60 points
    h. An additional 10 points for every 6.0" (15.24cm) increment above 46.5" (118.1cm)

6. *Robots* may lift *Ball Crates* or *Stacks* of *Ball Crates* off of the floor or *Home Zone* to gain additional *Stacking Bonus* points.
7. *Ball Crates Stacked* on the *Home Zone Platform* automatically begin their *Stacking Bonus* calculations as if they were already at height on top of 1 *crate* (i.e. scored *Ball Crates* on the *Platform* start their *Stacking Bonus* at 10 points instead of 0 points).

2.4.3 – SCORING IN THE END GAME PERIOD

The last thirty (30) seconds of the *Driver Controlled Period* is the *End Game*. During the *End Game*, teams may move their *Alliance*-colored *Bowling Ball* onto the Platform of their *Home Zone* to receive additional scores. Teams are not allowed to make contact with their opponent's *Bowling Ball* during the *End Game*. Teams may not try to score their *Bowling Ball* onto their *Home Zone* until the start of the *End Game*. The *End Game* score is recorded by the Referees at the end of the *Match* as follows:

1. *Parking* your *Alliance*-colored *Bowling Ball* in your *Home Zone Goal* is worth 30 points. Contact with a *Robot* is allowed.
2. *Parking* your *Alliance*-colored *Bowling Ball* in your *Home Zone* outside of the *Home Zone Goal* and not touching the *Playing Field* foam mats is worth 20 points. The *Bowling Ball* may be in contact with the perimeter walls, *Ball Crates* and/or a *Robot*.

2.4.4 – 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 any portion of the *Robot* goes outside of the perimeter wall and makes contact with anything outside of the *Playing Field* it will be disabled for the remainder of the *Match*. *Robots* may extend out-of-bounds during the act of scoring in their *Alliance's Off Field Goal*.

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

2.4.5 – GENERAL GAME RULES

<G1> At the beginning of a *Match*, each *Robot* must not exceed a volume of 18" (45.7cm) wide by 18" (45.7cm) long by 18" (45.7cm) tall. An offending *Robot* will be removed from the *Match* at the Head Referee's discretion.

a. Alignment devices 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*. 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 contact with the *Playing Field* or any game or field object. The first instance of contact will result in a warning, with any following instances resulting in a *Penalty* and/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 (i.e. touching a Gamepad) will result in a warning, with any following instances resulting in a *Major Penalty* or *Disqualification*.

<G6> Scores will be calculated for all periods of a *Match* at the end of each period when all objects on the *Playing Field* have come to rest.

<G7> *Robots* may not deliberately detach parts during any *Match*, or leave mechanisms on the *Playing Field*. If a detached component or mechanism is attached to a *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* are not in the spirit of the *FIRST* Tech Challenge and are not allowed. However, *Bowled Over!* 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 deliberate, 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. If a *Referee declares a Pinning Warning* during the *Match*, the offending *Robot* must back away at least 3 feet (1.5 floor tiles) from the *Pinned Robot*.

<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 and field elements from any grasping, containing, or holding mechanism without requiring that the *Robot* have power after the *Match*.

<G12> 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 start anywhere in the *Alliance's Home Zone Platform*. *Drive Teams* are required to stand in the *Alliance Station* location specified by the *Match* schedule to assure that the Logitech Gamepads are assigned to the correct *Drive Team* and *Robot*.

a. During the qualification *Matches*, the blue *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. *Alliance*s may waive their right to place their *Robots* on the *Playing Field* after the opposing *Alliance* places their *Robots* as specified above.

<G13> *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 Gamepad that was likely to have impacted which *Alliance* won the *Match*.
c. Loss of control of all four *Robots* due to a failure of the field's wireless router that was likely to have impacted which *Alliance* won the *Match*.

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

<G14> At the conclusion of the *Autonomous Period*, referees will record the score; then when needed, untangle *Robots*, place *Robots* on their drivetrain, make minor adjustments to *Robot* position, etc. so that the *Robots* can participate in the *Driver Controlled* portion of the *Match*.

<G15> Field and field element tolerances may vary by as much as +/-1.0" (2.54cm). Teams must design their *Robots* accordingly.

<G16> Egregious robot or team member behavior at the playing field, as determined by the referees, will result in a Major Penalty and possible disqualification. Subsequent violations will result in team disqualification. Egregious behavior includes, but is not limited to, repeated and/or flagrant violation of game rules, uncivil behavior towards Drivers, Coaches, competition personnel and event attendees, and repeated or flagrant unsafe behavior or actions.

2.4.6 – *BOWLED OVER!* SPECIFIC GAME RULES

<SG1> There are approximately 25 *Balls* (*Magnet* plus *Regular*) placed in each of the *Ball Tubes* before the beginning of the *Match*. The *Magnet Balls* will be placed in a random order in any of the *Ball Tubes*. *Teams* are not allowed to touch or reposition the *Bowling Balls*, *Balls*, *Ball Tubes*, or *Ball Crates* in any way prior to the start of a *Match*. Repeated violation of this rule may result in team *Disqualification*. There are no preloaded game objects in this year's game.

<SG2> Removing (de-scoring) *Balls* from the *Low Goal* is allowed. Deliberate de-scoring of *Balls* from the *Ball Crates* while in the Protected Area or *Off-field Goal* will result in *Major Penalty* (40 points) and a team *Disqualification*.

<SG3> *Balls* that leave the 12' x 12' area of the *Playing Field* will be placed back in play at the earliest safe opportunity by a designated game official at the approximate location where it exited unless it will score. *Drive Teams* are not allowed to return *Balls* onto the *Playing Field*. Violation of this rule will result in a *Penalty* (5 points) for the team per returned *Ball* and may result in a team *Disqualification*.

<SG4> *Robots* may not deliberately remove *Bowling Balls*, *Balls*, or *Ball Crates* from the *Playing Field*. *Teams* will be warned on a first occurrence. Repeated violations will result in a *Penalty* (5 points) per *Regular Ball* removed and a *Major Penalty* (40 points) per *Bowling Ball*, *Magnet Ball*, or *Ball Crate* removed with the possibility of a team *Disqualification*.

<SG5> Robots may only make contact with an opposing Alliance's Ball Crate(s) at one outside surface at a time and the crate must be in contact with the Playing Field floor or in contact with an element touching the Playing Field floor. Violations of this rule will result in a Penalty (5 points).

<SG6> Making contact with an opposing *Alliance's Ball Crate* or *Stack* while in its *Protected Area* and/or *Home Zone* is not allowed and will result in a major penalty (40 points). Making incidental contact with an opposing *Alliance's Ball Crate* or *Stack* where the contact doesn't change the score is allowed.

<SG7> Making contact with an opposing *Alliance's Robot* or carried *Crate* while the opposing *Alliance* is in the process of *Stacking* or carrying *Ball Crates* that are located in its *Protected Area* and/or *Home Zone* is not allowed and will result in a major penalty (40 points).

<SG8> *Stacking* a *Ball Crate* on top of an opposing *Alliance' Ball Crate* or *Stack* is not allowed and will result in a *Major Penalty* (40 points).

<**SG9>** Pushing an opposing *Alliance's Ball Crate* and/or *Bowling Ball* onto your *Home Zone* and/or *Protected Area* is not allowed at any time and will result in a *Major Penalty* (40 points).

<SG10> Making contact with an opposing *Alliance's Home Zone* during the *End Game* is not allowed and will result in a Major *Penalty* (40 points).

<SG11> A *Magnet Ball* may be scored in the *Alliance's* own *Off-field Goal* at any time of the *Match*. It will only be counted once at the end of the *Match*.

<SG12> Placing a *Ball* in the opposing *Alliance's Off-field Goal* is not allowed and will result in a *Major Penalty* (40 points) and a team *Disqualification*.

<SG13> Robots pushing their Alliance-colored Bowling Ball into a scoring position prior to the start of the End Game is not allowed and the Bowling ball will not count in the End Game bonus.

<SG14> *Robots* are not allowed to make contact with their opponent's *Bowling Ball* during the *End Game* and will result in a *Major Penalty* (40 points).

<SG15> *Robots* are not allowed to store, hold, control, contain, etc. more than fifteen (15) *Balls* at a time. Each *Ball* above the 15 *Ball* limit will receive a *Penalty* (5 points) and the *Robot* must pass a re-inspection prior to participating in another *Match*. *Balls* that are in contact with the *Playing Field* surface or are fully supported by a *Ball Crate* are excluded from this constraint. The ball-holding mechanism(s) of the *Robot* will

be inspected before it will be allowed to play (i.e. if the ball holding capability of your *robot* can hold 16 or more balls, the *Robot* will not pass inspection).

2.4.7 – *BOWLED OVER!* PENALTY SUMMARY

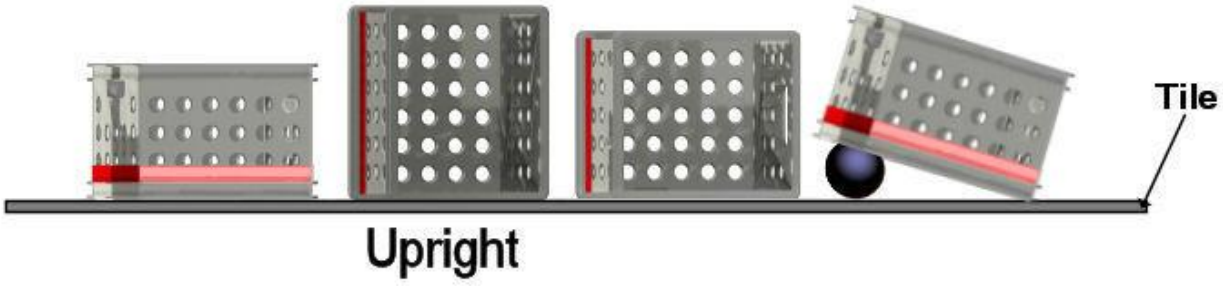
The following table shows the possible rule violations and their ramifications:

Violation	Ramification	Rule
Drive Team outside of *Alliance Station*	Warning; followed by 5 points per offense May lead to *Disqualification* for *Match*	<G3>
Drive Team contacts field or game object	Warning; followed by 5 points per offense May lead to *Disqualification* for *Match*	<G4>
Coach touches Gamepad 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 deliberately detaches parts in scoring area	*Robot* disabled and team *Disqualified* for *Match* Multiple infractions may result in *Disqualification* for the entire competition	<G7>
Deliberate 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 *Balls*, *Ball Tubes*, or *Ball Crates*	May lead to *Disqualification* for the *Match*	<SG1>
De-scoring of *Balls* from the opposing *Alliance's Ball Crates* in *Protected Area* or *Off-field Goal*	40 point *Penalty* and *Disqualification* for the *Match*	<SG2>
Drive Team returning *Ball*s to field during a *Match*	5 points per offense May lead to *Disqualification*	<SG3>
Removing a *Bowling Ball*, *Ball*, or Ball Crate from the field	Warning; followed by 5 or 40 points per offense May lead to *Disqualification* for *Match*	<SG4>
Robots may only make contact with an opposing Alliance's Ball Crate(s) at one outside surface at a time and the crate must be in contact with the Playing Field floor or in contact with an element touching the Playing Field floor. Violations of this rule will result in a Penalty	5 point *Penalty* per occurrence	<SG5>
Making contact with an opposing *Alliance's Ball Crate* or Stack in its Protected Area	40 point *Penalty* per occurrence	<SG6>
Making contact with an opposing *Alliance's Robot* or *Ball Crate* while in the process of Stacking in *Protected Area*	40 point *Penalty* per occurrence	<SG7>
Stacking a *Ball Crate* on top of opposing *Alliance's Ball Crate* or *Stack*	40 point *Penalty* per occurrence	<SG8>
Pushing an opposing Alliance's *Ball* Crate onto your *Home Zone* or *Protected Area*	40 point *Penalty* per occurrence	<SG9>

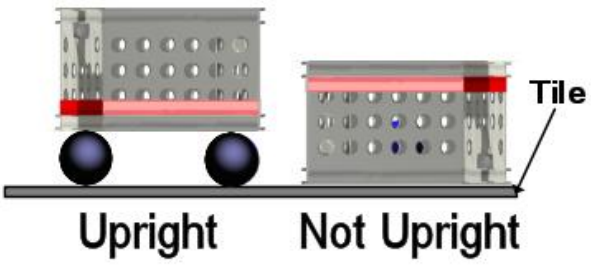
Violation	Ramification	Rule
Making contact with an opposing *Alliance's Home Zone* during *End Game*	40 point *Penalty* per occurrence	<SG10>
Playing a *Ball* in the opposing *Alliance's Off-field Goal*	40 point *Penalty* per occurrence and a *Disqualification*	<SG12>
Robots pushing their Alliance-colored Bowling Ball into a scoring position prior to the start of the End Game is not allowed and the Bowling ball will not count in the End Game bonus.	Bowling *Ball* will not be counted for the *End Game* bonus	<SG13>
Making contact with an opposing *Alliance's Bowling Ball* during *End Game*	40 point *Penalty* per occurrence	<SG14>
Storing, holding, controlling, containment, etc. of more than 15 *Balls*	5 point *Penalty* per *Ball* and required to pass a re-inspection	<SG15>

2.4.8 – BALL AND UPRIGHT CRATE SCORING EXAMPLES

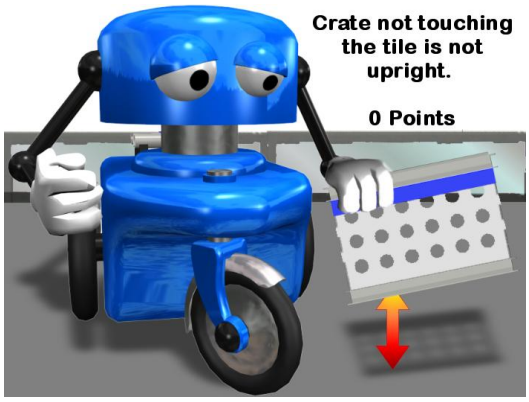
The following are examples of how *Balls* and *Upright Crates* will be scored:



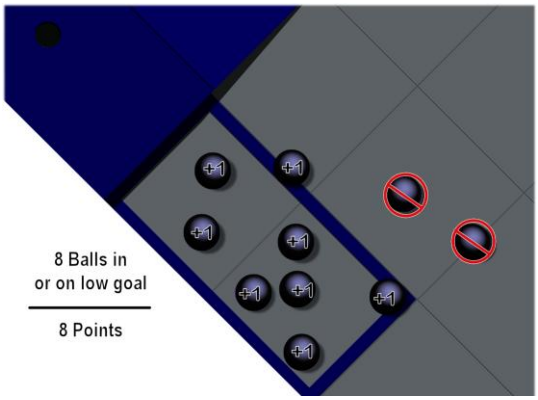
These four crates show legal orientations of the crates to count as upright (for 5 points each) at the end of the Autonomous Period. Each one has at least one edge of the crate bottom touching the field mats.



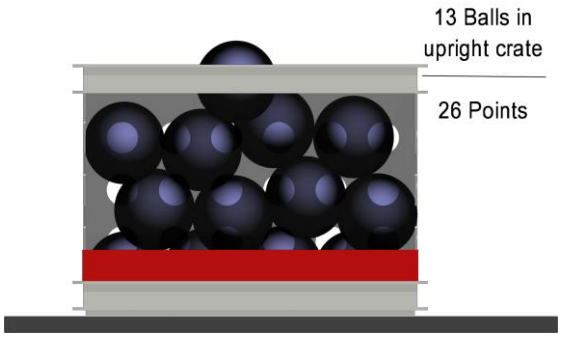
The first crate in this drawing is Upright and gets points. Even though the crate is not on the floor directly, one part of the bottom of the crate is in contact with the floor mat, platform, or ramp or with an element that is in contact with the floor mat, platform, or ramp.. The second one is not upright in that it does not have at least one edge of the crate bottom touching the field mat and has not been flipped over at all.



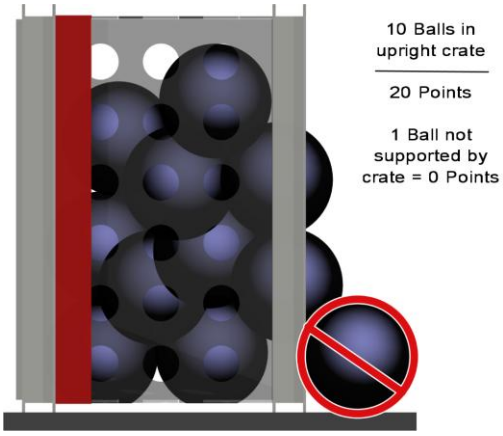
This picture shows a robot still holding a crate at the end of the autonomous period. This crate will not score because the crate does not have at least one bottom edge of the crate touching the field.



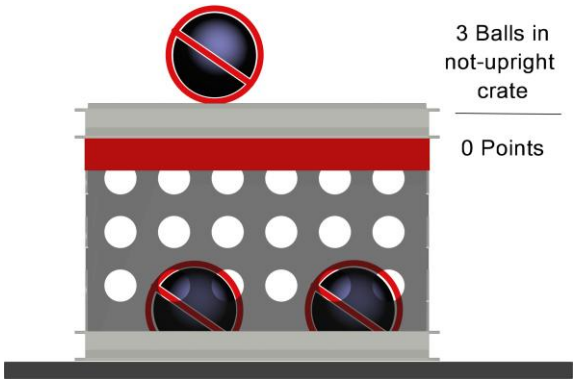
This picture shows how Balls in the low goal will be scored or not scored. There are 8 balls that are scored in this example. 6 of them are pretty obvious. The two others that are touching the lines also score based on the definition of breaking the plane of the outside edge of the tape outlining the goal. Remember: The referee ruling on this is FINAL.



This example shows a legal way for the balls to be scored in the crates. This one shows 13 balls in the crate fully supported by the crate or other balls within the crate.



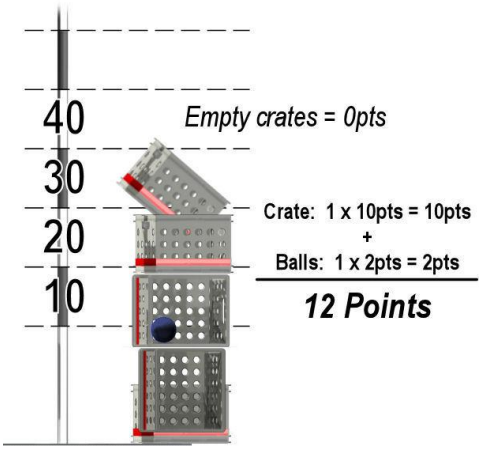
This one illustrates two points. 1) The crate is upright in that one bottom edge is touching the field. 2) There are 10 balls scored. The 1 ball that is touching the mat does not count. Balls that are touching anything other than the crate, a ball in the crate, or a robot from the opposing alliance do not count.



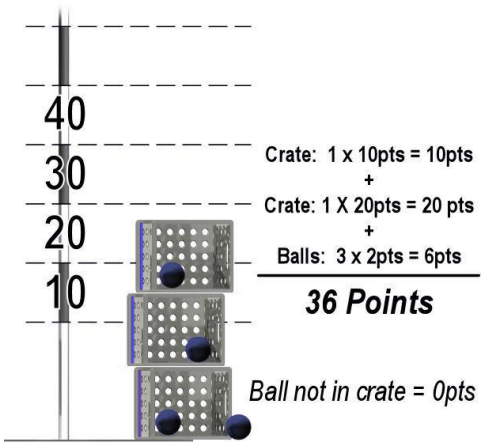
This crate does not have any balls legally scored in or on it. First, the crate is not upright. Second, the balls that are inside the crate are not fully supported by the crate (they are supported by the floor). The ball on top of the crate does not count because the crate is not upright.

2.4.9 – STACKING BONUS EXAMPLES

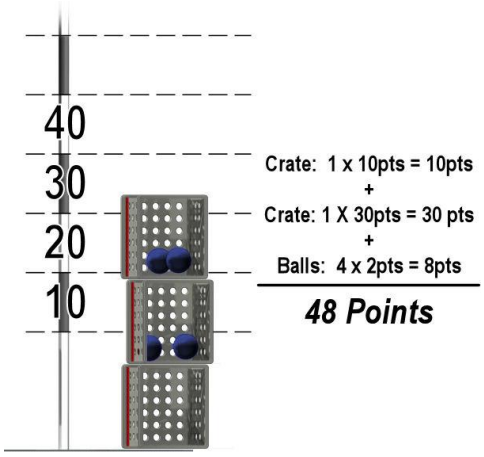
The following are examples of how the *Stacking Bonus* is calculated:



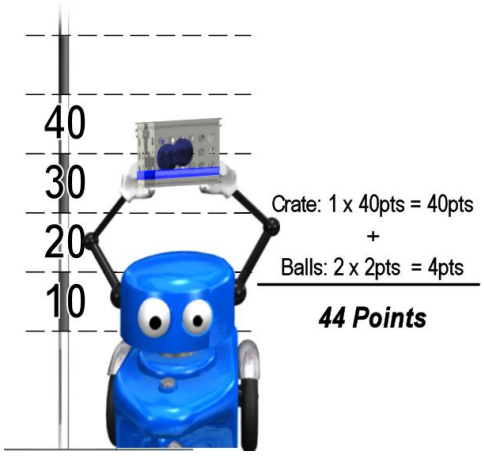
This example shows 1 ball scored (2 points) plus 4 crates stacked in various orientations. However, since not all of the crates have at least 1 ball scored in them, they do not get counted in the *Stacking Bonus*. Only the second crate (which is scored in the 10 point height) scores. So the *Stacking Bonus* is 10 points and the ball scoring is 2 points for a total of 12 points.



This example is similar to the one above however there is a ball scored in each crate in the stack. The balls are completely supported by the crate and nothing else except the one that is just resting on the field mat. So 3 balls are scored (6 points) and 3 crates are stacked – 1 in the 0 point range (the bottom one), 1 in the 10 point range, and 1 in the 20 point range. Stacking bonus is 30 points; ball scoring is 6 points for a total of 36 points.

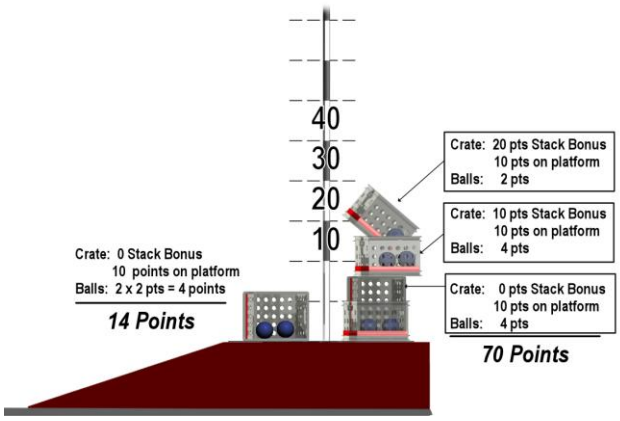


This example shows how a stack, based on the orientation of the crates, can skip a bonus range. There are 2 balls in two of the crates for a ball score of 8 points. There are also 3 crates stacked on end which shows 1 in the 0 range (which wouldn't have counted anyway since there are no balls scored in it), 1 in the 10 point range, and 1 in the 30 point range. Stacking bonus is 40 points; ball scoring is 8 points for a total of 48 points.



This example shows that a single crate elevated by a robot can also score a Stacking Bonus. There are 2 balls in the crate (4 points) and the robot (assuming it is resting on the field mat) raises the crate to the 40 point range for a Stacking Bonus of 40 points. Total points are 44 points.

Now if the robot was on top of the Home Zone platform, the Stacking Bonus would have started at 10 for a total score of 54 points.



These two examples are ways that stacks of crates will be scored when on the Home Zone platform. The stack on the left scores 4 points for the 2 balls plus a Stack Bonus of 10 points for being stacked on the platform (see Section 2.4.2 #15 – scored crates on the platform automatically begin their bonus at 10 points) for a total of 14 points.

The stack on the right scores 70 points – 10 points for 5 balls scored in crates plus 10 points for the lowest crate plus 20 points for the third crate plus 30 points for the topmost crate. The second crate does not get any bonus as there are no balls scored in it.

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 match 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*. The entire team may also be referred to as the *Alliance Captain*.

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 used as the tiebreakers when teams have equal *Qualifying Points*. *Ranking Points* are awarded in the amount of the final score of the losing *Alliance* in a *Qualifying Match*. The winning *Alliance* will receive the pre-penalized score of the losing *Alliance* as their *RP*. The losing *Alliance* will receive the final score (including penalties) of the losing *Alliance* as their *RP*.

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

3.3 – TOURNAMENT EVENT SCHEDULE

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

3.4 – COURTESIES AND RULES

You will hear the expression Gracious Professionalism (GP) 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 examples of GP are some of the 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. Follow the rules below while in the pit as well as in the audience so everyone can work and compete in a safe, sportsmanlike, friendly, and orderly manner.

Bands:	No live bands 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 noisemakers confiscated.
Internet/Wireless Network Access:	Teams may not setup a wireless computer network for any purpose (i.e. Internet access, team communication, team computer to robot, etc.) Teams are required to use the wireless computer network provided by the Tournament Organizers or venue for all robot communication. Internet access for the teams will be at the discretion of the Tournament Director.
Radios/Walkie-Talkies	Teams are not allowed to use Radios and walkie-talkies anywhere in the tournament facility.
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:	Sitting together in a group during competition matches makes the game more exciting and fun. It's where you can show support for your team. Since very often there is not enough seating to accommodate everyone, there has to be a policy regarding seating. Teams are not allowed to save seating space.
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 ANSI Z87.1 certified 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:	These activities and tools are not allowed in the pit areas or at the competitions unless the tournament director specifically allows them.

3.5 – EYE PROTECTION AND SAFETY

FIRST requires all teams to bring and supply ANSI Z87.1 certified safety glasses for 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.

Operators, players, and coaches will not be allowed in the competition area without them. Regular glasses and sunglasses do not qualify as safety glasses. If you wear prescription glasses, you must wear safety goggles over them or attach safety side shields.

3.6 – EVENT DAY OVERVIEW

The tournament will generally follow this agenda:

1. Team Check-in
2. Robot Hardware 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 CHECK-IN

As a team arrives at the venue, the Coach or other adult mentor should register the team with the tournament officials. During check-in, the Coach will receive a packet of information for the team that may include drive team

badges, a judging schedule, a map of the facilities and pits, and other information that is very important to the teams. The Coach should review all the material to make sure the packet is complete. At this time, the team should set up their Pit area and get familiar with the venue such as where the practice and playing fields are, where judging will take place, and understand the schedule.

3.6.2 – ROBOT HARDWARE 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. A copy of the official FTC "Robot Inspection Sheet" is located in another section. The "Robot Inspection Sheet" should be used by teams as a guide to pre-inspect their 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 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 at most events, but should only minimally participate (see Section 6 for more details).

3.6.4 – PRACTICE MATCHES

At the event, practice matches may be played in the morning 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 schedule. 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 each receive two (2) QP.
- Losing teams of a qualifying match receive zero (0) QP.
- If a qualifying match ends in a tie, all four teams receive one (1) QP.
- If a team is disqualified, they receive zero (0) QP.

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. The winning alliance will receive the pre-penalized score of the losing alliance as their RP. The losing alliance will receive the final score (including penalties) of the losing alliance as their RP.
- 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. 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.

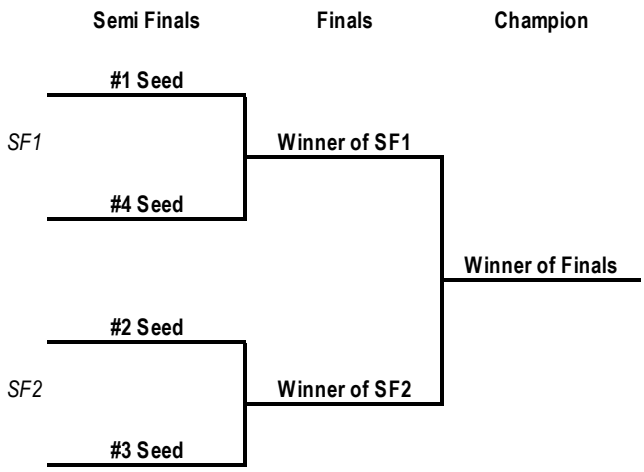
The alliance selection process will consist of a number of rounds of selections, such that all alliance captains will form elimination match alliances consisting of the requisite number of teams. These alliances will participate in a ladder-type tournament to determine the event's Champion Alliance. 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 (i.e. 1 -> 2 -> 3 -> 4). 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. This is when 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. 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 alliances 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.

3.7 – TOURNAMENT TYPES

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

3.7.1 - LOCAL EVENTS

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

3.7.2 – QUALIFYING TOURNMENTS

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

3.7.3 - 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 tournament in order to advance to the Championship. Championships may include teams from a geographic region, province, state, country, or several countries. Advancement eligibility for the World Championship is the same as moving on from Qualifying Tournaments to the local Championship Tournament and is based on the number of teams that are invited to the World Championships.

3.8 – ADVANCEMENT CRITERIA

Teams will advance to the next level of competition in the order indicated below according to the number of spots available. The advancement criteria will be applied to teams advancing from Qualifying Tournament to Championship Tournaments and from Championship Tournaments to the World Championship Tournament.

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

1. Qualifier Host Team (NOTE: Assuming that the team competes at one other tournament within the region and has met the criteria set forth by the Affiliate Partner in the agreement)(Applies only at the qualifying tournament level).
2. Inspire Award Winner
3. Winning Alliance Captain
4. Inspire Award 2nd place
5. Winning Alliance, 1st team selected
6. Inspire Award 3rd place
7. Winning Alliance, 2nd team selected
8. Think Award Winner
9. Finalist Alliance Captain
10. Connect Award Winner
11. Finalist Alliance, 1st team selected
12. Rockwell Collins Innovate Award Winner
13. Finalist Alliance, 2nd team selected
14. PTC Design Award Winner
15. Highest Ranked Team not previously advanced
16. Motivate Award Winner
17. Highest Ranked Team not previously advanced

3.9 – TOURNAMENT RULES

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

a. The referees will not review any recorded match replays or pictures.
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. Students are expected to support their questions by referencing specific rules and/or posts to the official FTC Q&A Forum.
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.

<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 in between matches.

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

<T4> Teams 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 ANSI 87.1 certified safety glasses or prescription glasses with side shields while in the pits or alliance stations during matches.

NOTE: *FIRST* requires all teams to bring and supply, for each competition, ANSI-approved non-shaded safety glasses for its team members, mentors, and guests. For our purposes, amber lenses that allow for 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.

3.10 – TEAM SPIRIT

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

3.10.1 – 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 7 – Team Resources for information about *FIRST* and FTC logo use requirements.

3.10.2 – 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.

3.10.3 – 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.

3.10.4 – 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 *Bowled Over!* Prior to competing at each event, all *Robots* will have to pass an inspection. Refer to Section 8 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 8 – 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 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" (45.72cm x 45.72cm x 45.72cm).

a. During inspection, the *Robot* 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:

Note: The only parts and materials allowed in the construction the *Robot* are listed in <R5>. No other parts and materials are permitted.

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) Servos (TETRIX 180 Degree HiTEC HS-475HB or HS-485HB and Continuous Rotation TETRIX W39177 & HiTEC HSR-1425CR 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"/60.96cm or shorter is recommended) must be used.
    4. Exactly one (1) TETRIX 12V Rechargeable NiMH Battery Pack. This battery pack may only be used to power the Samantha WiFi Communications module, the HiTechnic DC Motor Controllers, the HiTechnic Servo Controllers, and visible light LEDs. 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). Additional TETRIX battery packs are NOT allowed for ANY purpose.
    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 or W36117), the TETRIX R/C Receiver (Product Id W35496), the Infrared Electronic Ball (Product Id W991458) and the TETRIX DC Motor 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 (W979639), or six (6) AA batteries.
    3. LEGO Motors may be used with the following constraints (per NXT motor port):
        a. One (1) NXT Interactive Servo Motor (LEGO Part # W979842)
        b. One (1) XL Power Function Motor (LEGO Part # W778882)
        c. Two (2) E Power Function Motors (LEGO Part # W979670)
        d. Two (2) M Power Function Motors (LEGO Part # W978883)
        e. One (1) E Motor and one (1) M Motor
        f. You are allowed to use any number of NXT conversion cables to connect the Power Function Motors with the NXT (LEGO Part #s W770323, W778886, or W778871)
        g. You are NOT allowed to use any of the Power Function Battery Packs (LEGO Part #s W778881 or W778878)
    4. LEGO pneumatic elements are allowed. Teams may not modify LEGO pneumatic elements to attempt to change the working pressure limits of the elements.
    5. Any LEGO Approved NXT sensor (as indicated by the LEGO Mindstorms NXT Certified – Hardware label) is allowed.
    6. Any NXT compatible sensor from HiTechnic, including the NXT Touch Sensor Multiplexer, NXT Sensor Multiplexer and the NXT prototype boards (both solderable and solderless) is allowed.
    7. The HiTechnic 9-volt Battery Box that is sold as part of the NXT Sensor Multiplexer set may be used in conjunction with each NXT Multiplexer (i.e. one Battery Box per Sensor Multiplexer). It may be used only in conjunction with and to power the NXT Sensor Multiplexer(s).
    8. LEGO-Approved NXT extension cables are allowed. Approved cables are currently only available from LEGO and HiTechnic.
    9. Non-NXT electrical elements not specified above are not allowed, with the exception of RCX sensors.
    10. LEGO Duplo products are not allowed.

c. The following additional components may also be used:
    1. Any non-reinforced polymer-based plastic sheet material (e.g. polycarbonate, PVC, acrylic, ABS, Teflon, PETG, etc.) may be used with the following constraints:
        a. Thickness per sheet not greater than 0.125” (0.3175cm).
        b. 24” (60.96cm) maximum dimension on any one side
        c. Multiple sheets of different plastic materials are allowed with no maximum area constraint.
        d. Plastic sheets may be laminated together to form a block up to a maximum thickness of 0.5” (1.27cm).
    2. Plastic glue/cement is allowed (including PVC cement and cleaner), only for the joining of plastic pieces. Use of plastic glues/cements may or may not be allowed in the pits at tournaments based on site-specific rules or requirements.
    3. 3” (7.62cm) or smaller PVC, CPVC, or ABS flexible or rigid piping (of any schedule), not to exceed 36” (91.44cm) in total length (regardless of PVC size). Schedule 40 3” PVC has a nominal inside diameter of 3.068” (7.8cm) and is allowed.
    4. Commercial PVC couplings (i.e. Tee’s, elbows, couplings, caps, etc.) 3” (7.62cm) or smaller are allowed.

5. All plastics listed above (except for the PVC couplings) may not be purchased in a pre-formed manner.
6. Aluminum or Galvanized flat sheet (not patterned), not to exceed 576 sq. inches (3721 sq. cm) total area combined (regardless of thickness), 24" (60.96cm) maximum dimension and not greater than 0.0625” (0.15875cm) thick.
7. Aluminum 90-degree angle, up to 1” x 1” (2.54cm x 2.54cm) wide, 0.0625” (0.15875cm) thickness. No maximum length restraint.
8. Aluminum U-channel, up to 1” x 1” (2.54cm x 2.54cm) wide, 0.0625” (0.15875cm) thickness. No maximum length restraint.
9. Aluminum square tube, up to 1” x 1” (2.54cm x 2.54cm) wide, 0.0625” thickness. No maximum length restraint.
10. Aluminum round tube, up to 1” (2.54cm) diameter, 0.0625” (0.15875cm) thickness. No maximum length restraint.
11. Aluminum flat [bar], up to 1” (2.54cm) wide, 0.0625” (0.15875cm) thickness. No maximum length restraint.
12. All aluminum or galvanized items listed above may not be purchased in a pre-formed manner other than the specified shape (i.e. flat sheet, square tube, etc.)
13. 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. The rivet must be aluminum, nylon, or plastic, but the mandrel can be made of any material. Size not to exceed 0.25”(0.635cm) diameter and 0.50” (1.27cm) length (Ex: McMaster-Carr Part # 97447A651 or Home Depot SKU # PAA54 - 5B).
14. Rope or cord made from non-metallic materials such as nylon, polypropylene, hemp, cotton, sisal, etc. of any length, not to exceed 0.125” (0.3175cm) in diameter.
15. Plastic-coated wire rope with a bare wire diameter of 0.03125” (0.08cm) or smaller. Compatible compression sleeves, clamps and hardware may also be used only in conjunction with the plastic-coated wire rope.
16. Non-Slip Pad without an adhesive backing. There are no dimensional constraints. (e.g. McMaster Carr Part #69275T54 or Home Depot SKU #134555). Packaging material must list the product as Non-Slip Pad.
17. Unlimited length Threaded Rod (also known as All-Thread) not to exceed 0.375” (0.9525cm) diameter (e.g. McMaster Carr Part #94435A317).
18. All mechanical fasteners (nuts, bolts, screws, etc.) of any length, any thread type, up to 0.375” (0.9525cm) diameter. 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. Any size washer up to 0.75” (1.905cm) in outside diameter is allowed only if used in the mechanical fastening process (i.e. washers may not be used as ballast for robot weight).
20. Mechanical fasteners may be secured using Loctite® or a similar thread-locking product.
21. Any number of Rubber bands size #32 or smaller, (i.e. 0.125”/0.3175cm thick & 3”/7.62cm in circumference).
22. Surgical or latex Tubing 0.375" (0.9525cm) OD or smaller, unlimited total length (Ex: McMaster-Carr Part # 5234K45 or Home Depot SKU #769355).
23. Electrical tape and/or heat shrink tubing used only for insulation of electrical connections or for holding the motor leads onto the motors.
24. Universal Security Clips to hold PWM connections together, such as #2870 found at http://www.maxxprod.com/mpi/mpi-3.html.

25. PWM extension cables. These cables may either be purchased from a vendor or fabricated by the team.
26. Anderson 30 Amp PowerPole or similar Crimp style snap plug connectors and butt splice connectors for joining electrical wires are allowed. Power distribution panels may also be used (and is strongly recommended) to make wiring easier.
27. Any material strictly used as a color filter for a Light Sensor may be used.
28. 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).
29. Non-Metallic Cable ties (also known as Zip Ties) up to 11" (27.94cm) in pre-cut length may be used.
30. Custom-made brackets for securing the encoder to the 12V DC drive motors are allowed providing they are used only for that purpose.
31. #25 chain off-set half links (McMaster-Carr part # 6261K105 or AndyMark part # am-0682).
32. Visible light LEDs with their connected electronic circuits may be used as a cueing signal for the team or for decoration. If used, the purpose must be demonstrated during inspection. Power for the LEDs may be provided by the 12-volt TETRIX battery or by no more than one (1) battery not to exceed 9 volts and its compatible battery holder or battery cap.
33. Tape of any type or stick-on labels are permitted for the following:
    a. Targets for sensors.
    b. Labeling electrical components (wires, motors, servos, etc.).
    c. Team numbers or attaching team numbers to the *Robot*.
34. 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. Any compatible sensor may be connected to the NXT Prototype Board, provided that no other rules are violated. Sensors may be distributed throughout the *Robot*; they do not need to be physically attached to the 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.
e. The *Robot* must be designed to be controlled by no more than two (2) Logitech Gamepads.
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 or <R5>c32, 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.

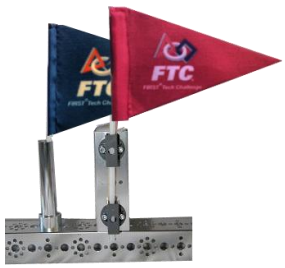
<R6> All parts listed in <R5>c that have a maximum constraint and that are used on the robot must be tracked through a Bill of Materials (BOM). **This list MUST be submitted at inspection and a copy should be included in your Engineering Notebook.** A sample BOM is included in Section 8 – Robot Inspection.

<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> The NXT controller and Samantha WiFi Communication Module **MUST** be accessible and visible by competition personnel including inspectors, referees, and Field Control System 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 liquid crystal 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.
e. The NXT Controller and Samantha WiFi Communication Module shall be mounted such that they are protected from contact with the *Playing Field* elements or other *Robots*. These and other electrical components (batteries, motor and servo controllers, switches, etc.) make poor bumpers and are unlikely to survive the rigors of game play when attached in a *Robot*-to-*Robot* contact area.
f. It is strongly recommended that teams electrically isolate the motor controllers, NXT, and Samantha Communication module from the robot frame. Teams should also use the Anderson Power connectors (or similar) to help ease power distribution.

<R9> *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" (0.635cm) OD x 0.200" (0.5cm) ID x 8.250" (20.955cm) length with a triangular flag 4.000" (10.16cm) high x 6.000" (15.24cm) wide. These may vary from event to event.

<R10> The *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)

<R11> 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 Field Control System that it is a spare.

<R12> Teams MUST install the Samostat program onto their NXTs for the competition. The program files are installed when the team installs the Samantha 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 is released, the programming environment is updated, or firmware is installed on the NXT

<R13> Teams MUST install the Program Chooser onto their NXTs for the competition. Once installed, the team does not have to install it again unless firmware is installed on the NXT, a new version of the Program Chooser code is released or the programming environment is updated.

a. LabVIEW: The Program Chooser is automatically installed the first time the NXT is connected to the computer.
b. ROBOTC: The Program Chooser is automatically installed with the ROBOTC firmware.

<R14> 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
    4. Samantha power wires are 18 AWG
d. Welding, soldering (except as listed below), brazing, gluing, melting or attaching in any way that is not provided within the TETRIX System or specified in other rules is NOT 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.

<R15> *Robot*s 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” (1.27cm) 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.

<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 3.0 or later (firmware version 9.0 or later)

b. LabVIEW for LEGO MINDSTORMS (NXT Firmware version 1.31 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 for the sensor mux, the external battery for the visible LEDs, 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 (1.2 meters) above the playing field surface, nor travel a horizontal distance greater than ten (10) feet (3 meters).

<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 *Driver-Controlled* mode correctly using the latest version of the FCS. This is done during Software Inspection.

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 6 – Awards & Judging Criteria for more details on how your Engineering Notebook will be judged.

5.3 – THE NOTEBOOK

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

Electronic/Online: Teams may choose to use electronic or online programs to create their Engineering Notebook. For the purposes of judging, teams must print out their Engineering Notebooks and place them in a binder, no larger than 1.5". All pages must be numbered and in order. Only one copy is required per team. Online videos or demonstrations cannot be reviewed by judges.

Written: Spiral-bound, Laboratory, or documentation notebooks are available through your school or local stationary supply store or you may use the notebook supplied by Rockwell Collins delivered to you in your Kit of Parts. 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 is required per team.

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. The date, and start/stop times should be recorded when starting a new page. Each day should start with two columns:
   a. Task Column – What 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.
    Tip: Bring a second copy of the BOM for robot hardware inspection.

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 – 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 – JUDGING & AWARDS CRITERIA

6.1 – 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 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.

6.2 – *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 are allowed to win the Inspire Award only once during each tournament level (Qualifying and Championship). Once a team wins the Inspire Award at a Qualifying tournament, they are only eligible to win the other judged or alliance awards at subsequent Qualifying tournaments. The same restriction applies to teams attending multiple Championship tournaments.

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.

6.3 – *FIRST* TECH CHALLENGE AWARD CATEGORIES

6.3.1 – *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 an Inspire Award at a Championship, they are no longer eligible to win the Inspire Award at additional championship tournaments they may attend. Similarly, once a team wins an Inspire Award at a Qualifying tournament, they are no longer eligible to win the Inspire Award at subsequent Qualification tournaments.

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, *FIRST,* and the *FIRST* Tech Challenge 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

6.3.2 –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

6.3.3 – *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 complement its purpose. This award is sponsored by Parametric Technology Corporation (PTC), developers of the CAD tools, Creo and Mathcad. PTC gives licenses to the FTC student teams for these software products to help them with their designs. Use of these tools is not required to be eligible, however, teams that use them in their design are given extra consideration for this award.

Guidelines for the PTC Design Award

- Team 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.)

6.3.4 – *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

6.3.5 – *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

6.3.6 – *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.

6.3.7 – *FIRST* TECH CHALLENGE PROMOTE AWARD (OPTIONAL)

This judged award is being piloted for the 2011-2012 season and may not be given at all tournaments. Please contact your tournament organizer to determine if it will be given at an event you attend.

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

Guidelines for the Promote Award

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

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

Team must submit a one-minute long PSA video one full week prior to the event to be eligible for this award. Additional submissions are welcome but will not be eligible for awards. Where to submit videos will be posted on the FIRST Tech Challenge website soon after Kickoff.

PSA Subject for 2011-2012 Season

- Create a one-minute public service announcement (PSA) video that begins with the following sentence: ***I'm going to change the world …***

6.3.8 – *FIRST* TECH CHALLENGE COMPASS AWARD (OPTIONAL)

A *FIRST* Tech Challenge team is about more than building robots, and competing at tournaments - it is a journey to a destination through trial and error, success and failure, with challenging new technology and obstacles to navigate where no road maps are provided. So how does a team find their way?

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

Guidelines for the Compass Award

- Only one video submission per team will be considered. Teams may submit new or updated videos at each tournament.
- The video must be submitted at least one week prior to tournament day. Instructions for submitting videos will be released after Kickoff on the www.usfirst.org website.
- Videos must not be longer than 60 seconds (including introduction and credits if you choose to use them).
- Videos must be submitted in AVI, WMV or MOV format. Remember that the winning video may be shown on a large screen during the awards ceremony. Use the best resolution you have available for your final version.
- Video presentations are confidential, and may not be made public or shared with other teams prior to the award presentation.
- Team must submit an Engineering Notebook.

6.3.9 – *FIRST* TECH CHALLENGE JUDGES AWARD (OPTIONAL)

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

6.3.10 – *FIRST* TECH CHALLENGE WINNING ALLIANCE AWARD

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

6.3.11 – *FIRST* TECH CHALLENGE FINALIST ALLIANCE AWARD

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

6.4 – 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.

6.4.1 – 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.

6.4.2 – 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.

6.4.3 – 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 tournament, 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 and mentors (no more than two mentors). 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 may not contribute to the judging process. The judges will want to know the highlights about the team; its history and make up; what the team achieved during the competition season; and the experiences that were gained. Team representatives' abilities to answer the questions or elaborate on robot design functions or attributes will be evaluated during the team interview. Check with the event organizer to see if Mentors and Coaches are allowed to observe the team interview. Mentors should always keep in mind that FTC is a student-centered activity and it is about giving the students a unique and stimulating experience in all aspects of the program.

6.5 – *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* Jr. LEGO League (Jr. FLL), *FIRST* LEGO League (FLL), the *FIRST* Tech Challenge (FTC), and the *FIRST* Robotics Competition (FRC). This is a fun and exciting experience for teams in all programs to participate.

FIRST Tech Challenge teams earn their way to the FTC World Championship with their performance on and off the field. Advancement Criteria for the FTC World Championship is outlined in Section 3 and is similar to advancing from local Qualifiers to local Championship tournaments. Teams will still be responsible for their own entry fees, lodging, and travel costs to the FTC World Championship.

SECTION 7 – TEAM RESOURCES

7.1 – 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.

7.2 – *FIRST* CONTACT INFORMATION

You can reach the *FIRST* Tech Challenge staff by e-mail at FTCteams@usfirst.org. The office is open Monday through Friday from 9:00 a.m. to 5:00 p.m., EST. Be sure to provide your team number in your message and leave contact information. Refer to the information below for the appropriate resource.

7.3 – 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 *Bowled Over!* 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.

Note: Accounts are updated weekly by the *FIRST* 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 ftcforum.usfirst.org or by browsing to forums.usfirst.org and following the "*FIRST* Tech Challenge" link found under the "*FIRST* Programs" heading. Please do not use the FRC Game Q&A for FTC Questions. 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 visible only 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:

Description	Website
FTC information, game information, FAQs, and team resources	www.usfirst.org/roboticsprograms/ftc/
FTC Game Q&A	ftcforum.usfirst.org

7.4 – 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.

7.5 – 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 8 – ROBOT INSPECTION

8.1 – OVERVIEW

This section describes *Robot* Inspection for the *FIRST* Tech Challenge 2011-2012 competition, *Bowled Over!* It also lists the inspection definitions and inspection rules.

8.2 – DESCRIPTION

The FTC *Robot* will be required to pass hardware and software inspections before being cleared to compete. These inspections will ensure that all FTC *Robot* rules and regulations are met. Initial inspections will take place during team check-in/practice time. A copy of the official FTC "Robot Inspection Checklists" is located in this section. It is STRONGLY RECOMMENDED that teams use these checklists as a guide to pre-inspect the *Robot* prior to arriving at the event.

8.3 – 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 or Driver-Controlled programs that serves to ready the Robot for a match.

Robot Sizing Box – A sturdily constructed cube with the interior dimensions; 18 inch (45.72cm) by 18 inch (45.72cm) by 18 inch (45.72cm) that has one open side with an interior opening size of 18 inch (45.72cm) by 18 inch (45.72cm). The Sizing Box is used for Robot Inspection as outlined in Section 8.4.

8.4 – INSPECTION RULES

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

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

<I3> The FTC Official Team Number must be displayed on the *Robot* prior to inspection as defined in Section 4.2 <R15>.

<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:

a. by mechanical means with the *Robot* in a power-OFF condition
b. by a *Robot* Initialization Routine in the Autonomous mode program that may pre-position the servo motors, with the *Robot* in a power-ON condition, to the desired position by means of a single instruction to the HiTechnic Servo controller for each servo motor effected. 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 provided by the Tournament Host that is placed near the TETRIX ON-OFF switch 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 is required to 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 2.4.4 **<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	R4
	Overall Inspection	
	Team Number is visible from at least 2 sides (180 degrees apart) and is written in 3" tall, 1/2" stroke on a contrasting background	R15
	Robot's capacity to store, hold, control, contain, etc. racquetballs does NOT exceed 15 balls	SG15
	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 does NOT contain any hazardous materials	R3
	Robot poses NO obvious unnecessary risk of entanglement	R3
	NXT battery can be easily removed without disassembly	R8a
	USB ports (NXT and Samantha) are easily accessible	R8b
	NXT Controller liquid crystal display and Samantha LEDs are readily visible	R8c
	NXT Controller and Samantha Module buttons are readily accessible	R8d
	Robot Flag Holder is present and adequately holds the flag during normal robot operation	R9
	TETRIX Power Switch is positioned to be readily accessible to competition personnel and installed properly	R10
	ALL Decorating Components on the Robot NOT meeting FTC Inspection Criteria are NON FUNCTIONAL	R5f
	Parts Inspection - Official TETRIX and LEGO Components	
	All sensors attached directly to the NXT are LEGO Certified (only LEGO or HiTechnic products)	R5b
	FTC Robot does not utilize any of the packaging materials	R5c
	Robot has only one (1) NXT controller	R5b
	Each NXT motor port (A, B or C) controls no more than: (i) one NXT Interactive Servo Motor, or (ii) one XL Power Function Motor, or (iii) two E Power Function Motors, or (iv) two M Power Function Motors, or (v) one E plus one M Power Function Motors	R5b
	Robot has exactly one (1) Samantha module	R5a
	Robot has no more than eight (8) 12V DC drive motors	R5a
	Robot has no more than twelve (12) Servos	R5a
	Robot has no more than four (4) HiTechnic DC Motor or Servo Controllers (in any combination)	R5a
	Robot has one (1) official NXT rechargeable battery pack (AC or DC) or six (6) AA batteries (not both)	R5b
	Robot has exactly one (1) official FTC 12 V DC NiMH battery pack	R5a
	HiTechnic 9-volt Battery Box (if used) is only used as part of the NXT Sensor Multiplexor	R5b
	LEGO Pneumatic Elements have NOT been modified to change the working pressure limits	R5b
	Additional Parts Inspection	
	Team has provided a Bill of Material of <R5>c parts	R6
	Robot utilizes Flat Plastic sheets that were no more than 24" in any dimension and 0.125" thick prior to fabrication into its final form on the Robot (unlimited area)	R5c
	Robot contains no more than 36" total combined length of PVC piping not thicker than 3" inside diameter.	R5c

	PVC couplings are 3” or smaller	R5c
	Robot contains aluminum or galvanized flat sheet (in any combination) of no more than 576 sq. inches total area combined, 24" maximum dimension per piece and not greater than 0.0625" thick	R5c
	Aluminum 90-degree angle has dimensions no greater than 1”x1”x0.0625” thick (unlimited length)	R5c
	Aluminum U-channel angle has dimensions no greater than 1”x1”x0.0625” thick (unlimited length)	R5c
	Aluminum Square Tube has dimensions no greater than 1”x1”x0.0625” thick (unlimited length)	R5c
	Aluminum Round Tube has dimensions no greater than 1”diameter x 0.0625” thick (unlimited length)	R5c
	Aluminum Flat Bar has dimensions no greater than 1” x 0.0625” thick (unlimited length)	R5c
	Nylon/plastic or aluminum Pop Rivets are no larger than 0.25” diameter and 0.50” length	R5c
	Rope or cord is 0.125” diameter or smaller (unlimited length)	R5c
	Plastic coated wire rope is 0.03125” diameter or smaller (unlimited length)	R5c
	Non-Slip Pad is NOT adhesive backed (unlimited area)	R5c
	Threaded Rod is 0.375” diameter or smaller (unlimited length)	R5c
	Rubber bands are size #32 (0.125” thick & 3” in circumference) or smaller	R5c
	Surgical or Lexan tubing is 0.375" outside diameter or smaller (unlimited length)	R5c
	Electrical tape or heat shrink tubing is only used for electrical insulation or securing motor leads to motor terminals	R5c
	Cable ties are non-metallic and their pre-cut length does not exceed 11”	R5c
	LEDs (if used) must be visible light and only used as a signaling device or for decoration	R5c
	Construction Inspection	
	Electrical components have NOT been modified from their original state except the HiTechnic Prototype Board	R14
	NO method of attachment NOT provided by the TETRIX is used except as specifically allowed by the rules (i.e. PVC cement on PVC, etc.)	R5/R14
	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 2011-2012 *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	
	Samantha unit has the latest firmware and competition connection settings flashed to it (see instructions below)	
	NXT named with 4 digit team number (optional hyphenated letter appended)	R11
	NXT Firmware Version (circle one) LabVIEW ROBOTC 1.31+ 9.0+	R16
	NXT Sleep Timer set to OFF	
	Samostat program is loaded on the NXT	R12
	Queuing Process	
	Team understands that no software changes are allowed in Queue Area.	
	Team understands that the match schedule is only an estimate. Matches may start prior to or after the scheduled time and it is the teams' responsibility to monitor schedule changes and show up when required.	
	Team knows where to receive alliance flags and where to return them after the match.	

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

Queuing Area Inspection Completed by: _____

HOW TO FLASH SAMANTHA FOR COMPETITION AT SOFTWARE INSPECTION

1. Obtain the flash drive created by the FTA/FCS operator with the Samantha.hex file and network key folders loaded.
2. Turn off the 12V Battery (robot battery).
3. Remove the NXT USB cable from Samantha and insert the flash drive into the USB port on the Samantha.
4. Hold down the red button on the Samantha, then power on the 12V robot battery. Release the red button when the LEDs on the Samantha light up.
5. The Samantha LEDs will complete TWO cycles of: Red-White-Blue-White-Red.
6. After two full light cycles are complete (approximately 40-seconds), remove the flash drive from the Samantha and reconnect the NXT USB cable.

Important: ENSURE two full LED light cycles complete before removing the flash drive from the module.

FIELD INSPECTION CHECKLIST:

	Field Setup
	Connection with tournament-supplied FCS is successful
	Robot Setup procedure on the field is understood and successful
	Robot Functionality
	(Optional) Team successfully started the robots Autonomous mode
	Robot did not move between autonomous and Tele-op periods
	Robot's Tele-op mode started when commanded to do so by the Field Control System
	Robot stopped at the end of the 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 ends until instructed to do so by the referees
	Teams understand they are to clear the alliance station as soon as the match ends with one team member remaining behind to collect the robot

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

2011-2012 FIRST Tech Challenge Extra Parts Bill of Materials

Team Number **Team Name**

Material	Original Width or Diameter	Original Length	Original Thickness	Used Width or Diameter	Used Length Max Side	Total Sq Inches	Must not exceed
Plastics							
Polycarbonate (Lexan)							Original 0.125" thickness and 24" on any one side. No maximum sq. in. constraint
Kydex							
ABS							
PETG							
Teflon							
Other (specify):							
Other (specify):							
Other Components							
Sheet Aluminum							0.0625" thickness and 24" on any one side. 576 sq. in. max
PVC Pipe (I.D. for diameter)							36" max length