


**FTC**

*FIRST Tech Challenge*

**FACE**  **OFF!**

**2008**

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Section

1



# Introduction

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## 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.

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 80,000 committed and effective volunteers who are key to introducing close to 200,000 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 high-school-aged young people, *FIRST* LEGO® League (FLL) for 9 to 14 year-olds, and Junior *FIRST* LEGO League for 6 to 9 year-olds. Also located at *FIRST* headquarters is the research and development facility called *FIRST* Place. *FIRST* Place is integral to game design, new program development, evaluation, and professional development of *FIRST* mentors.

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

**Dean Kamen,  
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*.

### 1.3 – What is the *FIRST* Tech Challenge?

*FIRST* Tech Challenge (FTC) is the newest addition to the family of *FIRST* programs. FTC grew out of a need for a mid-level robotics program to transition teams from *FIRST* Lego League to *FIRST* Robotics Competition. Piloted for two years as the *FIRST* Vex Challenge, FTC became an official *FIRST* program and was renamed *FIRST* Tech Challenge in 2007.

The FTC Competition Kit challenges students' creative problem-solving skills by enabling them to build robots that do amazing things. 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](http://www.usfirst.org) website. When you bring dedicated, enthusiastic students and a mentor together, the results can be phenomenal!

### 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.

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

The *FIRST* Tech Challenge is a student-centered activity and is about giving students a unique and stimulating experience. We want students to learn the value of teamwork and to respect everyone's ideas and contributions to the team. *FIRST* values are about appreciating our differences and learning what those differences add to our lives. *FIRST* programs succeed most fully when team members bring the *FIRST* values they learn back to their communities.

### 1.5 – The *FIRST* Tech Challenge – 2008 Season

*FIRST* Tech Challenge teams will participate in the *FIRST Face Off!* challenge for the 2008 season. Each game match is made up of two distinct types of play – operator-controlled and autonomous. Each tournament features alliances of two teams playing side-by-side on the playing field. Teams will compete to score the most points by completing various tasks, including removing colored hockey pucks from a rack and placing them in various locations on the FTC field. Teams will be challenged by traversing over rough and/or slippery terrain and will have to navigate off and on a ramp in the beginning and end of a match.

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

Teams 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 events. The *FIRST* Championship Event in Atlanta, GA is an exciting event where teams from FTC, FRC, and FLL celebrate their accomplishments with other teams, family, and friends. Eligibility requirements for the FTC World Championship will be released after Kickoff on the [www.usfirst.org](http://www.usfirst.org) website.







# 2



# The Game

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## Section 2 – The Game

### 2.1 – Overview

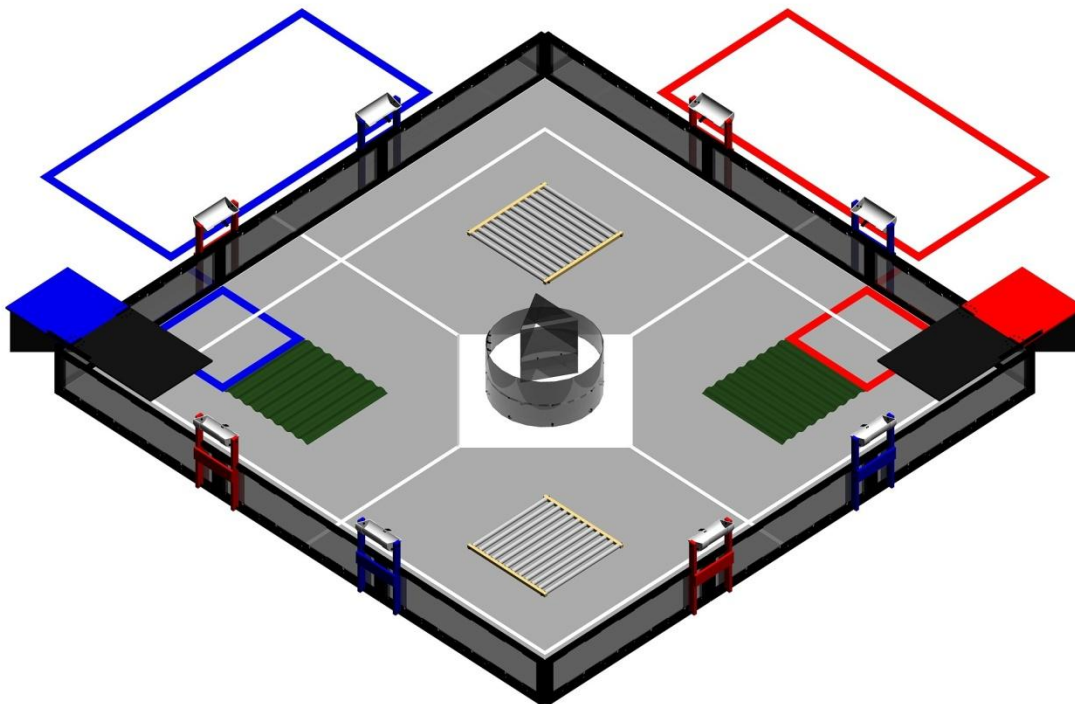
This section describes the *FIRST* Tech Challenge game for the 2008 season, called *FIRST Face Off!*. It also lists the game definitions and game rules.

### 2.2 – Game Description

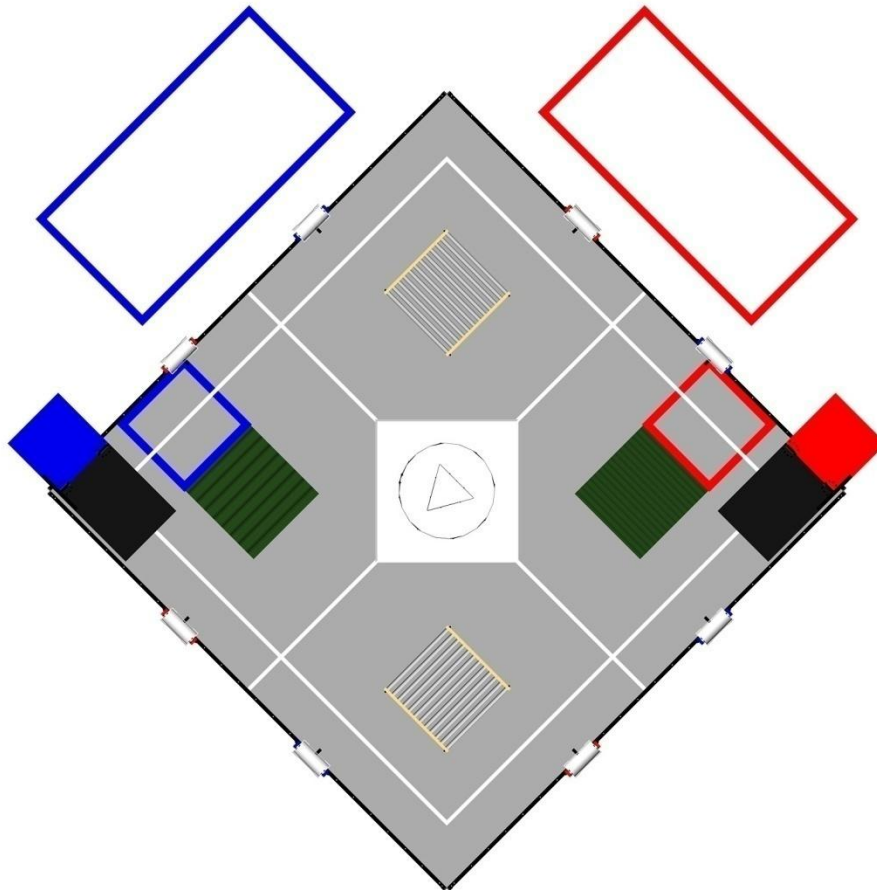
Matches are played on a field initially set up as illustrated in the figures below. Two *alliances* – one “red” and one “blue” – composed of two teams each, compete in each *match*. The object of the game is to attain a higher score than your opposing *alliance* by removing colored hockey *pucks* from 8 different *racks* around the field and placing them in various locations in the *center scoring area*. Teams will be also be challenged by traversing over rough and/or slippery terrain located in 4 different areas of the field and will have to navigate onto the field at the start of a match and back off the field at the end of the match.

In the *Autonomous Period*, pucks scored in the center scoring area will be totaled and each alliance will keep those points whether the pucks are descored (pucks will count once) or not (pucks will be scored a second time).. There will also be bonus points awarded to alliances for knocking pucks down from their racks based on their location from the *Starting Location*.

There are a total of 70 *pucks* (35 red & 35 blue) available as scoring objects in the game.



**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](http://www.usfirst.org) under FTC Team Resources for exact field dimensions, a full field BOM and the exact details for field construction. Items listed in the full field BOM are recommended for an official Field Kit. Suitable substitutions are acceptable. Lower cost field options are also provided at [www.usfirst.org](http://www.usfirst.org)



## 2.3 – Game Definitions

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

*Alliance Station* – The designated region where the *drivers* and *coach* stand during any *match*.

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

*Center Scoring Area* – The Center Scoring Area is considered to be part of the field (see *Off the Field*). The Center Scoring Area is composed of three concentric scoring locations:

*Outer Square* – A 36-inch square platform resting  $\frac{3}{4}$  inch off of the playing field with chamfered edges.

*Middle Circle* – A 24-inch diameter cylinder that rests on top of the Outer Square with 12-inch cylindrical walls.

*Center Triangle* – A triangular-shaped object that measures 20-inches tall with 12-inch sides.

*Coach* - A student or adult mentor designated as the team advisor during the match and identified as the person wearing a “*coach*” badge.

*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*.

*Far Rack* – The puck-holding *rack* for each alliance, furthest from the robot's starting location. For the Red Alliance, it is on the opposite wall from the Red *Alliance Station* and directly in front of the Blue Alliance's starting location. For the Blue Alliance, it is on the opposite wall from the Blue *Alliance Station* and directly in front of the Red Alliance's starting location.

*Field* – The part of the playing surface that is composed of the SoftTiles (mat), the 4 rough or slippery terrain areas, and the *Scoring Area*. For the 2008 game, the definition of the field does NOT include the walls.

*Match* - A *match* consists of an *autonomous period* followed by a *driver-controlled period* for a total time of 2:30.

*Near Rack* – The six other *racks* (3 red and 3 blue) that are not the *Far Rack*.

*Off the Field* – A robot is considered “off the field” if there are no parts of it that are touching the *field*. The field walls, starting *platform* outside the field, and the ramp can be considered “off the field”. The *Scoring Area* is considered to be on the field.

*On-Field Starting Position* – Two (2) tiles, one red and one blue, that are the starting location for one robot of the alliance corresponding to the color of the tile (or tape surrounding the tile). Robots must be fully within the tile and may not break the vertical plane formed by extending the tile edges infinitely above the tile's outer edge of the tape.

*Platform* – The starting location of one of each alliance's robots that sits outside the field. The platform measures 18-inches by 18-inches and rests 12-inches off of the floor. Also known as the *Off Field Starting Location*. The platform does NOT include the ramp.

*Puck* – A scoring element for the 2008 FIRST Tech Challenge game, FIRST Face Off!. The puck is a Mylec or Franklin floor or street hockey puck that is made of molded plastic and measures 1-inch thick and 3-inches in diameter. It weighs approximately 2 ounces. Each puck will be painted red or blue. Depending on the tournament, there may be other markings on the puck faces for sponsors logos or other decorations.

*Rack* – One of eight locations that hold *pucks* prior to the start of a *match*.

*Robot* – Anything (which has passed inspection) a team places in their corresponding *Starting Locations* prior to the start of a *match*.

*Scored* – A *puck* is scored if the entire puck is in the space extending infinitely above any one of the three scoring zones in the *Center Scoring Area*, and is not touching a robot of the same alliance color.

*Starting Location* – The location where teams place their robots before the start of the match. There are two starting locations per alliance.

*On Field Starting Location* – An approximately 24-inch x 24-inch location on the field located in front of the corresponding alliance station. The robot may start in any orientation anywhere within the taped boundary that is no larger than 24-inch x 24-inch.

*Off Field Starting Location* – Also known as the *Platform*. The *platform* measures 18-inches by 18-inches and rests 12-inches off of the floor. Attached to the *Platform* is an 18-inch x 24-inch ramp that initially starts in a raised position. The robot is required to push the ramp down and drive off the platform in order to score pucks on the field.

## 2.4 – Game Rules

### 2.4.1 – Scoring

- A *puck* that is scored in the *outer square* of the *center scoring area* is worth one (1) point for the corresponding *alliance*.
- A *puck* that is scored in the *middle circle* of the *center scoring area* is worth three (3) points for the corresponding *alliance*.
- A *puck* that is scored in the *inner triangle* of the *center scoring area* is worth five (5) points for the corresponding *alliance*.
- A *robot* that is *off the field* at the end of a *match* is worth ten (10) points for the corresponding *alliance*.

### 2.4.2 – Scoring in Autonomous Mode

- Any *pucks* that are scored during the *autonomous period* will be counted at the end of the autonomous period. If those pucks stay in the *Center Scoring Area* throughout the rest of the match, the pucks will be scored a second time.
- If a *robot* successfully clears the *pucks* off a *near rack* during the *autonomous period*, the corresponding *alliance* (based on color of the pucks) will score 5 points for each *near rack* cleared. If the *far rack* is successfully cleared, the alliance corresponding to the color of the rack will score 10 points.

### 2.4.3 – Safety Rules

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

<S2> If a *robot* goes completely out-of-bounds (outside the playing field), it will be disabled for the remainder of the *match*. But it will be eligible for the 10 points described in 2.4.1.

**Note:** The intent is NOT to penalize *robots* for having mechanisms that inadvertently cross the field border during normal game play.

## 2.4.4 - General Game Rules

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

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

<G2> Each team shall include up to two *drivers* and one *coach*.

<G3> During a *match*, the *drivers* and *coach* must remain in their *alliance station* and can not make any contact with the *field*.

<G4> *Pucks* that leave the playing field are considered out of play. These *pucks* will not be returned to the field during a *match*.

<G5> *Drivers* and *coaches* are prohibited from making intentional contact with any game or field object. The first instance of intentional contact will result in a warning, with any following instances resulting in a disqualification.

<G6> During a *match*, *robots* may be remotely operated only by the *drivers* and/or by software running in the on-board control system. If a *coach* touches his/her team's controls anytime during a *match*, the *robot* will be disabled and the team disqualified.

<G7> Scores will be calculated for all *matches* when all objects on the field have come to rest.

<G8> *Robots* may not intentionally detach parts during any *match*, or leave mechanisms on the field. If a detached component or mechanism is attached to the *center scoring area* and prevents additional scoring of *pucks*, the team will be disqualified. Multiple infractions may result in disqualification for the entire competition.

<G9> Strategies and mechanisms aimed solely at the destruction, damage, tipping over, or entanglement of *robots* or *scoring areas* are not in the spirit of the *FIRST Tech Challenge* and are not allowed. However, *FIRST Face Off!* is a highly interactive contact game. Some tipping, entanglement, and damage may occur as a part of normal game play. If the tipping, entanglement, or damage is ruled to be intentional, the offending team may be disqualified from that *match*. Repeated offenses could result in a team being disqualified from the remainder of the competition.

<G10> *Robots* must be designed to permit easy removal of *pucks* from any grasping mechanism without requiring that the *robot* have power after the *match*.

<G11> Field tolerances may vary by as much as +/-1" and *puck* tolerances may vary as much as +/- 1/8" and +/- 0.5 ounces. Teams must design their *robots* accordingly.

## 2.4.5 – FIRST Face Off! Specific Game Rules

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<SG1> At the beginning of each *match*, one *alliance robot* must be placed inside the field in the *on field starting location*. The other alliance robot must be placed in the *off field starting location*. The robot must successfully navigate off the platform and onto the field during the match in order to score pucks. If the robot cannot get onto the field, it will be eligible for 10 points as described in 2.4.1.

- During the qualification matches, the red *alliance robots* must be placed on the field first.
- During the elimination matches, the lower seeded *alliance robots* must be placed on the field first.

<SG2> Prior to the start of each *match*, each *alliance* will have three (3) *pucks* available to preload into their *robots*.

- a. A *puck* is considered to be legally preloaded if it is touching the *robot* and not touching any part of the playing field, field wall, ramp, or game objects.
- b. No *robot* may preload more than two (2) *pucks*.

<SG3> *Pucks* set in the *racks* before the beginning of the *match* are placed in a set pattern. Teams are not allowed to touch or reposition the *pucks* in any way prior to the start of a *match*. Repeated violation of this rule may result in team disqualification.

<SG4> In the event a single *puck* meets the definition of *scored* in more than one *goal* at the conclusion of either period, that *puck* will count only once for the highest point value possible. No single *puck* can ever earn an *alliance* more than five points at the conclusion of a *match*.

<SG5> Removing (de-scoring) *pucks* from the *center scoring area* will be allowed.

<SG6> A *robot* cannot pin (inhibit the movement of an opposing *robot* while in contact with one or more field elements) an opposing *robot* for more than five seconds. If a referee determines this rule to be violated, the offending *robot* will be disabled for the match.



## Section

# 3



# The Tournament

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## Section 3 – The Tournament

### 3.1 – Overview

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

### 3.2 – Tournament Definitions

*Alliance Captain* – A student chosen to represent their team during *Alliance Selection* for the final *Elimination Matches*.

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

*Elimination Match* – A match used to determine the champion alliance. Alliances of three face off in a series of matches, with two teams playing in each match. The first alliance to win two matches will proceed to the next round.

*Event Registration* – When teams first arrive at the tournament they must register their robots with the field control computer. This involves connecting the field control computer to the NXT controller via a USB cable. *Event registration* occurs only once, while *Match Registration* occurs every time a robot approaches the field to compete.

*Match Registration* – Before each match the teams must register their robot with the field control operator. This involves connecting the field control computer to the NXT controller via a USB cable. At this time each team will be assigned two controllers to use for that match. Teams will also be given their flags to place onto their robots.

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

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

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

*Ranking Points (RPs)* – The second basis of ranking teams. *Ranking points* are awarded in the amount of the score of the losing alliance in a *Qualifying Match*.

### 3.3 – Practice Matches

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

### 3.4 – Qualifying Matches

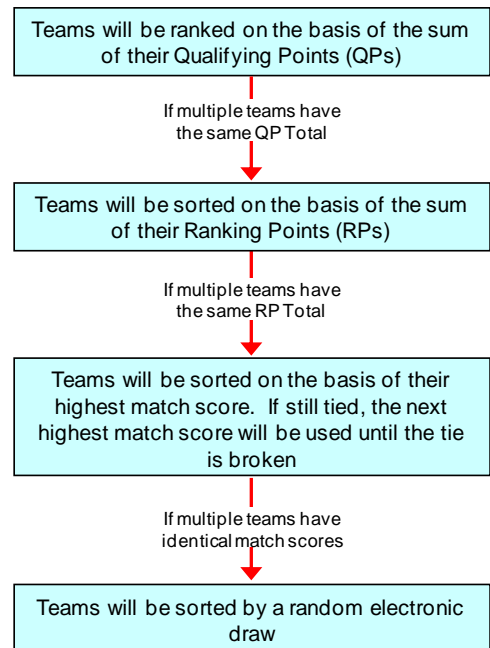
### 3.4.1 – Schedule

- The *qualifying match* schedule will be available prior to opening ceremonies on the day of competition. This schedule will indicate alliance partners and match pairings. It will also indicate the alliance's color – red or blue – for the matches.
- The *qualifying matches* will start immediately after opening ceremonies in accordance with the qualifying match schedule.
- Teams will be randomly assigned an alliance partner to compete against two randomly assigned opponents in each *qualifying match*.
- All teams will be **scored** on the same number of *qualifying matches*.
- In some cases, a team will be asked to play in an additional *qualifying match*, but will not receive credit for playing this extra match.

### 3.4.2 – Rankings

- At the conclusion of each match, *Qualifying Points (QP)* will be issued:
  - Winning teams of a *qualifying match* receive two (2) *QP*
  - Losing teams of a *qualifying match* receive zero (0) *QP*
  - If a *qualifying match* ends in a tie, all four teams receive one (1) *QP*
  - If a team is disqualified they receive zero (0) *QP*
- All teams in each *Qualifying Match* will also receive *Ranking Points (RP)*.
  - The number of ranking points assigned for each match, is that of the losing alliance's score.
  - In the event of a tie, both alliances will receive the same *RP* (equal to the tie score).
  - If a team is disqualified they receive zero (0) *RP*
  - If both teams on an alliance are disqualified, the teams on the winning Alliance will be awarded their own score as their *RP* for that match.

#### Tournament Rankings & Tie Breakers



- For a *qualifying 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*.

## 3.5 – Elimination Matches

- The *alliance selection* process will consist of two rounds of selection, such that eight *alliance captains* will form elimination alliances consisting of three teams.
- These eight alliances will participate in a tournament to determine the event champions.
- If a team is disqualified during an *elimination match*, then their entire alliance is disqualified, and the match will be recorded as a loss.

### 3.5.1 – Alliance Selection Process

- Every team will choose a student to act as a team representative.
  - These student representatives will proceed to the playing field at the designated time to represent their teams in the *alliance selection*.
- There will be eight alliances formed in the *alliance selection*.
- 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 an *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 an invitation, 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 another invitation.
- This process will continue until all eight *alliance captains* have been designated and chosen one alliance partner.
- The same method is used for each *alliance captain's* second choice. Any teams remaining after alliance eight makes their second choice will not compete in the *Elimination Matches*.
- During matches, two teams from an alliance will play on the field. **Any team that sits out the first match in an elimination series must play in the second match, with no exceptions.** Teams should consider the robustness of the robots when picking alliance partners.
- Prior to each *elimination match*, the *alliance captain* must let the referee know which two teams will be playing in the upcoming match

### 3.5.2 – Match Ladder

The *elimination matches* will play in a ladder format as shown on the right.

### 3.5.3 – Elimination Scoring

In the elimination rounds, 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, as follows:

- The first alliance to win two matches advances.
- Any tied matches will be replayed until one alliance has two wins, and advances.

### 3.6 – Tournament Rules

**<T01>** Referees have ultimate authority during the competition. **Their rulings are final.**

- a. The referees will not review any recorded replays.
- b. Any questions for the referees must be brought forward by a student drive team member within the time period of two (2) matches.
- c. Team members are not allowed onto the field for any reason other than to place or retrieve their robots. Inspection of the field elements by team members for the express purpose of determining scoring is prohibited.

**<T02>** The only people permitted on the playing field are the three drive team members who are identified by the drive team badges. These badges are interchangeable.

**<T03>** There are no time outs in the qualifying rounds; in the elimination rounds, each alliance will be allotted ONE time out of no more than three minutes. The matches must progress according to schedule.

- a. If a robot cannot report for a match, at least one member of the team should report to the field for the match.

**<T04>** Teams will be guaranteed a minimum of five minutes between matches.

**<T05>** All team members, including coaches, must wear safety glasses or glasses with side shields while in the pits or alliance stations during matches.

### 3.7 – Small Tournament Structure

In the case that a tournament has less than 24 teams (the requisite amount to have eight full alliances), the tournaments will be played with one of the following structures.

- If there are less than 24 teams, but more than 16 teams
  - Alliances will still consist of three teams
  - The number of picking teams in the alliance selection will be equal to the amount of teams divided by three, less any remainder. (e.g. If there are 19 teams,  $19/3 = 6.33 \rightarrow 6$  picking teams)
  - The match ladder follows the same format as a full tournament, with byes being awarded when there is no applicable alliance. (e.g. If there are seven alliances, there would be no 8<sup>th</sup> alliance, thereby awarding a bye to the 1<sup>st</sup> alliance in the quarter-finals.)

- If there are less than 17 teams
  - Alliances will consist of two teams
  - The number of picking teams in the alliance selection will be equal to the amount of teams divided by two, less any remainder. (e.g. If there are 13 teams,  $13/2 = 6.5 \rightarrow 6$  picking teams)
  - The match ladder follows the same format as a full tournament, with byes being awarded when there is no applicable alliance. (e.g. If there are seven alliances, there would be no 8<sup>th</sup> alliance, thereby awarding a bye to the 1<sup>st</sup> alliance in the quarter-finals.)





# 4



# The Robot

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## 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 student team to perform specific tasks when competing in *FIRST Face Off!*. Prior to competing at each event, all robots will have to pass an inspection. Refer to Section 9 for the Robot Inspection Guidelines and Inspection Checklist.

### 4.2 - Robot Rules

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

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

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

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

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

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

**<R3>** The following types of mechanisms and components are NOT allowed:

- a. Those that could potentially damage playing field components.
- b. Those that could potentially damage other competing robots.
- c. Those that pose an unnecessary risk of entanglement.
- d. Those that are designed to flip or tip over goals or other robots.

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

- a. During inspections, robots will be placed into a "sizing box" which has interior dimensions matching the above size constraints. To pass inspection, a robot must fit within the box without exerting ANY force on the box walls or ceiling (i.e., if the robot cannot be held inside the constraints by the box itself).
- b. Robots may expand beyond their starting size constraints after the start of a match.
- c. Any restraints used to maintain starting size (i.e. zip ties, rubber bands, string, etc.) MUST remain attached to the robot for the duration of the match.

**<R5>** Robot construction is constrained to the following:

- a. Any part included in the Official FTC competition kit may be used (except as limited below).
  - Only one (1) NXT Controller
  - Up to four (4) 12V DC drive Motors
  - Up to six (6) Servos
  - Up to three (3) NXT motors
  - Only one (1) 12 VDC NiMH may be used to power the *Robot*. This battery must be identical to those supplied in the kit of parts. (Note: the TETRIX™ battery 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).
  - One (1) NXT rechargeable battery pack or six (6) AA batteries (any type).
  - The packaging, manual binders, Styrofoam, cardboard, plastic bags, etc. from the kits are NOT included and CANNOT be used for robot construction. Only the TETRIX and LEGO® parts themselves are allowed.
- b. The following additional components may also be used:
  - One additional Logitech Gaming Controller
  - Any Vex® structural metal and fasteners (except the Linear Slide Pack, Vex part Number: LINEAR-SLIDE-PK-2)
  - Any LEGO® approved NXT sensor
  - Any NXT compatible sensor from HiTechnic, including the NXT Touch Sensor Multiplexer and the NXT prototype boards (both solderable and solderless)
  - Any part from the TETRIX system except for the R/C controller
  - One additional FTC controller (servo or DC motor controller)
  - One piece of polycarbonate plastic, 12" x 24" x not greater than .1" thick
  - One piece of aluminum, 12" x 24" x 1/16" thick
  - 1/8" Rope, any length
  - 12" x 15" of Non-Slip Pad
  - Universal Security Clips to hold PWM connections together, such as those found at <http://www.maxxprod.com/mpi/mpi-3.html>
  - Any material strictly used as a color filter for a Light Sensor.
  - 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*.
- c. Teams may add non-functional decorations from parts not on the above list, provided that these parts are non-functional, do not affect the outcome of the match, are not hazardous to themselves or other teams, and must be in the spirit of "Gracious Professionalism".
- d. No additional components may be used.

**<R6>** All parts that are used must be tracked through a Bill of Materials (BOM). This list can be included in your Engineering Notebook.

**<R7>** During inspections if there is a question about whether something is an official TETRIX, LEGO, or Vex 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>** No more than one NXT Controller may be used to control a single robot during the tournament

- <R9> Parts may NOT be modified as follows:
- Motors, extension cords, sensors, controllers, battery packs, and any other electrical component may NOT be altered from their original state in ANY way.
  - Welding, soldering (except teams using the NXT Prototype Board – Solderable) brazing, gluing, melting or attaching in any way that is not provided within the TETRIX System will NOT be allowed.
  - Mechanical fasteners may be secured using Loctite® or a similar thread-locking product. .
- <R10> Robots **must** display their team number (numerals only, e.g. “106”).
- The judges, referees, and announcers must be able to easily identify robots by team number.
  - Team number must be visible from two sides of the robot (180 degrees apart).
  - The numerals must each be at least three inches high, at least in 3/4-inch stroke width and in a contrasting color from their background.
- <R11> The NXT controller must be accessible by competition personnel including inspectors, referees, and field control operators.
- The NXT battery must be easily removed without disassembly of the robot.
  - The USB port on the NXT must be easily accessible to allow for rapid registration at the match.
- <R12> Robots **must** include a mounting device to securely hold one FTC Robot Identification Flag throughout an entire match.
- The flags will be provided at the event**
  - The flag tube dimensions are .250” OD x .200” ID x 8.250” length with a triangular flag 4.000” high x 6.000” wide.
  - The flag-mounting device may not be a non-reinforced antenna tube.

### 4.3 – Programming Guidelines

Teams will have access to [www.ftctraining.com](http://www.ftctraining.com) as a resource to learn how to program with NXT-G, LabVIEW, or ROBOTC. The bulletin boards at the site will be managed daily by Robotics Academy staff. Information on the most current versions of the programming softwares can be found at <http://www.usfirst.org/community/FTC/content.aspx?id=6650>.

#### **NOTE TO TEAMS:**

##### **For NXT-G or LabVIEW:**

You **MUST** download the most current version of the NXT device firmware to your NXT device in order to compete in the FIRST Tech Challenge (FTC) competition.

The field management system at the FTC competition cannot communicate with your robot unless you use the most current version of the firmware on the NXT device. The FTC software provides the correct version of this firmware.

Refer to the FIRST Tech Challenge Software Installation Instructions printed document, available as part t of the FTC kit, for information about installing the FTC software.

Refer to Chapter 4, Controlling the Robot with the FTC Controller Station, of the Getting Started with the FIRST Tech Challenge Software manual for information about downloading the firmware from either LabVIEW or LEGO®

MINDSTORMS® to the NXT device. Access the Getting Started with the FIRST Tech Challenge Software manual by navigating to the National Instruments\LabVIEW 8.5\manuals directory or the LEGO Software\LEGO MINDSTORMS Edu NXT directory and opening FTC\_Getting\_Started.pdf.

**For ROBOTC:**

The field management system at the FTC competition cannot communicate with your robot unless you use ROBOTC firmware version 7.52 or higher on the NXT device. The 1.40 version of ROBOTC provides the correct version of this firmware.

Users of ROBOTC can refer to the instruction on the CD packaging for help on installing ROBOTC, or to the built-in help documentation in ROBOTC under "Help - Getting Started - Downloading Firmware (NXT)" for a step by step guide on how to download the latest firmware.

# 5



# Engineering Notebooks

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## 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 sample pages from an award winning *FIRST* Tech Challenge Engineering Notebook.

### 5.2 – What is an Engineering Notebook?

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

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

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

### 5.3 – The Notebook

**Electronic/Online:** Teams may choose to use electronic or online programs to create their Engineering Notebook. For the purposes of judging, teams must print out their Engineering Notebooks and place them in a binder, no larger than 1” . All pages must be electronically numbered and in order. Only one copy is required per team. Online videos or demonstrations cannot be considered this year.

**Written:** Laboratory or documentation notebooks are available through your school or local stationary supply store.

There are many different types to choose from, using the following criteria:

- Use a notebook with a stitched binding.
- **Do not** use a loose leaf or spiral bound notebook.
- Numbered pages are recommended (but not necessary) so that pages cannot be substituted or deleted.
- Only **one** Engineering Notebook will be 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. So here are the guidelines:

- Document EVERYTHING!!

- Engineering Notebooks should be organized enough to have an outsider understand your team and your journey.
- Written entries should be in **Permanent Ink – Not Pencil**.
- 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.*
- Start a fresh page at every meeting. Your team number, date, and start/stop times should be recorded when starting a new page. Each day should start with two columns:
  - Task Column – What your team is doing and discovering?
  - Reflection Columns – Where your team records thoughts on what is happening and any questions that need to be answered.
- Entries should be made by every team member, initialed, and dated.
- 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.*
- 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.
- 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.
- 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.  
**Tip:** Pictures or sketches of your robot designs are recommended as part of a thorough documentation.

### 5.5 – Judge’s Tips

- 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!
- 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.
- 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.
- Don’t forget to put your team number in your Engineering Notebook, so we know who to return it to after the judges have seen it!

### 5.6 – Virtual Help

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

### 5.7 – Notebook Examples

The following examples were taken from Team 74 Overdrive from Bridgewater, New Jersey. They were the Amaze Award winners at the 2007 FTC World Championship, as well as members of the winning alliance.

TITLE 11/6/07 Meeting Project No. \_\_\_\_\_ Book No. \_\_\_\_\_ 29

From Page No. \_\_\_\_\_ Start Time: 6:00pm End Time: \_\_\_\_\_

We are getting ready for a scrimmage this Saturday - 11/10/07.

Tasks	Reflection	Event - Dequessa
1) Mount and adjust RRG - Rapid Ring Gatherer	1) Required some additional mounting changes	Called
2) Tighten conveyor system	2) Tried zip ties; failed	\$5000.00
3) Test Grabber system	3) Could not test because <del>the</del> gear links were not fully implemented	Donation
4) Put v-system on bot	4) Postponed to next meeting	THANKS
5) Mount electronics controller/PC	5) Guide to RRG successfully installed	Uwe Hoffmann
Proposals	Proposals	
1) List docs for autonomous	1) Acknowledged make ideas - <del>not</del>	
2) Name robot	2) To be decided next meeting	
3) Goal Retriever	3) To be decided next meeting	

Tyler and James worked on getting of conveyor system working. The most important part of our design is getting the ring gathering mechanism to work in tandem with the conveyor.

Labels in diagram: rings go this way, Rings go up conveyor, hook to grab part.

Recorded by: Maxwell Butler Date: 11/6/07 Verified by: Dino Butler Date: 11/6/07 To Page No. \_\_\_\_\_

TITLE Overview of Robot Project No. \_\_\_\_\_ Book No. \_\_\_\_\_ 13

From Page No. \_\_\_\_\_ Here is an overview of the robot.

Labels in diagram: Flip out deliverer, Ring sorter, Drive train, Claw, Lock and Load, Ring sorter, Drive train, Claw, Lock and Load.

This is the quad rack pinion system that we call the lifts it lifts the deliverer cage.

Flip out deliverer. This is the flip out deliverer. It rotates inside the robot by hooking the peg in side the robot. When the lifts go up the peg disengages and it flips out.

Ring sorter. Servo turns and pushes out ring sorter. This index upsets the cage system.

Drive train. This is the drive system. It uses a 84 tooth gear, one 32 tooth gear and two 60 tooth gears. The 84 tooth sits on drive wheel. Both 60 tooth gears are powered by motor. 32 tooth gear is used as an idler.

Claw. This is the claw system. The claw flips up at end of travel. The locking plate helps the claw pivot when the robot drives.




Lock and Load. This is the locking system that allows the ring system to buy the ground. Intake roller are used with bevel gears to get power.

Recorded by: Tyler Axel Date: 4/14/08 Verified by: James Withy Date: 4/14/08 To Page No. \_\_\_\_\_

102 Project No. \_\_\_\_\_ Book No. \_\_\_\_\_ TITLE Build Meeting 2/19/08

From Page No.	Task	Reflection
2	Update lab notebook	1 Update task
2	Fix 4 intake	2 Pick up rings new
4	Build Claw design	3 Success & how some progress
4	Tap into the battery	4 No progress
5	Test Motor 4	5 Tested with the Refract
6	Buy Sensor	6 No progress
7	Decide on claw design	7 Decided to design both

We realized that our prototype for goal grabbing designs were good but still prototypes. We felt like we had decided on a design yet, and we needed to begin building a final design. We talked about advantages & disadvantages and we also did a House of Quality diagram. This is what it looked like:

	Scale	Key
Fast Speed	5-1	5+ best
Power (Strength)	3-5	4+
Travel Distance	4-5	5+
Ease of Use	4-4	2+
Programming	5-3	1+ worst
Looks like a Robot	4-4	
Ability to Pick Up	5-5	
Ability to Drop	4-3	
Build Ease	4-3	
	1-5	

We agreed that ~~all~~ the sensors & claw were equal in Fast Speed, Ease of Use, Look to look like a robot, & ease of use. We were representing the best quality possible of both the sensors & claw in ~~all~~ all categories. Sometimes we didn't agree and took a vote, averaging the results to get a specific number. The results came within one point. We decided that it was too close & we felt like the team was split down the middle on the issues. In the end, we decided to do a side-by-side build of both designs. We just didn't have enough pro/con data.

David, Aris, & I were working on the side-by-side when they started it out, we could not pull the sensor out.

Recorded by: Anna Adams Date: 2/19/08 Verified by: Lucas Date: 2/19/08

# 6



## At The Event

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## Section 6 – At The Event

### 6.1 – Overview

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.

### 6.2 – Tournament Event Agendas

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

### 6.3 – Courtesies and Rules

You will hear the expression *Gracious Professionalism* often throughout your involvement in the *FIRST* Tech Challenge. One of our main goals is to encourage all team members to conduct themselves with kindness, consideration, and sharing.

We hear heartwarming stories of teams sharing parts, helping to build and/or repair competing robots, and helping rookie teams avoid preventable pitfalls. These are examples of some side benefits of being involved with this organization.

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

<b>Bands:</b>	No live bands in the audience or pit.
<b>Battery Safety:</b>	Charge in an open, well-ventilated area.
<b>Fire Extinguishers:</b>	Located at the pit administration station and on the playing field.
<b>Food:</b>	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.
<b>Music/Noise:</b>	No loud music, audio systems, whistles, banging sticks, blow horns, etc. They interfere with announcements and prevent teams from hearing important announcements. Power may be shut off and/or noise makers confiscated.
<b>Internet Access:</b>	No internet access... at all.
<b>Team Safety Captain:</b>	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.
<b>Safety Glasses:</b>	All team members and onlookers must wear safety glasses in the pit and on the playing field. If you wear glasses, you must wear safety goggles over them or wear attach safety side shields to them. Teams are required to bring enough safety glasses/goggles to supply its team members and its guests.

<b>Running:</b>	There will be no running in the pit.
<b>Painting:</b>	There will be no painting in the pit.
<b>Sales:</b>	Because of site regulations/contracts, <i>FIRST</i> cannot allow teams or individuals to sell items, such as T-shirts, pins, etc., at any events.
<b>Seat Saving:</b>	Not allowed, we need seats to get the public comfortable and interested.

## 6.4 – Competition Overview

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

Operators, players, and coaches will not be allowed on the competition field without them. Regular glasses and sunglasses do not qualify as safety glasses. **You must wear safety goggles over them.**

Goggles are not required to be worn over regular glasses **if** the regular glasses are made of polycarbonate / plastic material similar to that in safety glasses **and** safety side shields are attached.

### 6.4.1 – Practice Rounds

The competition fields may be open to anyone who would like to practice before the opening ceremonies. Your FTC Affiliate Partner and local event staff will provide specifics about practice matches.

### 6.4.2 – Judge’s Interviews

There will be a ten to fifteen-minute interview scheduled for every team to meet with the judge’s throughout the event. Please have at least two student team representatives available; the entire team/robot is encouraged to participate.

### 6.4.3 – Robot Identification with the Field Management System

At FTC Tournaments, teams will need to identify their NXTs with the Field Management System (FMS) computer(s) prior to the start of the tournament (likely during Inspection) and before each match as they are setting up the field (part of the field queuing process).

Each team will be required to "name" their NXT with their official FTC Team number expanded to four digits (e.g. FTC Team #123 would name their NXT "0123"). 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"). This spare NXT can also be registered with the FMS computer(s) during inspection as well.

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 FMS that it is a spare.



#### 6.4.4 – Match List

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Competition personnel will distribute the match list to teams on the day of the tournament.

#### 6.4.5 – Scouting

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This information has been provided by the 2007 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.

#### 6.4.6 – Early Matches

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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.

#### 6.4.7 – Maintaining Schedule

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The queue team will work together throughout the day to line up teams for competition matches and maintain the schedules. It's 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.

### 6.5 – Team Spirit

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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.

### 6.5.1 – Team Styling

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When deciding on a team name or acronym, consider how you can work a theme around it to make your team more fun and recognizable. Refer to Section 8: Team Resources for information.

### 6.5.2 – Banners and Flags

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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.

### 6.5.3 – Spectators and Field Etiquette

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Teams are permitted to have 2 drivers and 1 coach at the field during their scheduled matches. Spectators are not allowed on the field at any time and must remain outside of the designated field 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 competition 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.

# 7



## Judging and Awards Criteria

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## Section 7 – Judging & Awards Criteria

### 7.1 – Overview

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

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

### 7.2 – *FIRST* Tech Challenge Awards Eligibility

To ensure fairness to all teams and to provide equal opportunity for all teams to win an award at a *FIRST* Tech Challenge Championship Tournament, teams are only eligible to win an award at the first three Championship Tournaments that they attend. Those teams who compete in more than three Championship Tournaments do so for the purpose of being involved in the fun and excitement of the tournament and not with the intention of winning multiple awards.

### 7.3 – *FIRST* Tech Challenge Award Categories

#### 7.3.1 – *FIRST* Tech Challenge Inspire Award

This formally judged award is given to the team that truly embodied the ‘challenge’ of the FTC program. The team that receives this award is chosen by the judges as having best represented a ‘role model’ *FIRST* Tech Challenge Team. They are a top contender for all other judging categories and are 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 event received an automatic invitation to the FTC World Championship Event.

#### Guidelines for the Inspire Award

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

### 7.3.2 – *FIRST* Tech Challenge *Design* Award

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New for the 2008 season, this judged award recognizes design elements of the robot that are both functional and aesthetic. All successful robots have innovative design aspects; however, the Design Award is presented to teams that incorporate industrial design elements into their solution. These design elements could simplify the robot's appearance by giving it a clean look, be decorative in nature, or otherwise express the creativity of the team. The winning design should not compromise the practical operation of the robots but compliment its purpose.

Guidelines for the Design Award

- Team must submit an Engineering Notebook
- Robot differentiates itself from others
- Design is both aesthetic and functional
- Well thought out basis for the design (why i.e. inspiration, function, etc.)

### 7.3.3 – *FIRST* Tech Challenge *Innovate* Award

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The *FIRST* Tech Challenge 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 Innovate Award.

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

### 7.3.4 – *FIRST* Tech Challenge *Connect* Award

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

Guidelines for the Connect Award

- Team provides clear examples of outreach to community

- Team has worked to develop an in-person or a virtual connection with the engineering, science or technology community
- Team has a business plan or other way of determining their fundraising needs and a plan to achieve their fundraising goal
- Team has a plan to give back to their community

### 7.3.5 – FIRST Tech Challenge *Motivate* Award

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

#### Guidelines for the Motivate Award

- Team spirit is consistent throughout the team and the competition.
- Team is enthusiastic
- The team functions well as a team
- Team enthusiasm is evident in their community outreach

### 7.3.6 – FIRST Tech Challenge *Think* Award

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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, brainstorming, 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 Chapter 5: Engineering Notebooks for a complete description and format specifications.

### 7.3.7 – FIRST Tech Challenge *Winning Alliance* Award

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

### **7.3.8 – FIRST Tech Challenge Finalist Alliance Award**

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

## **7.4 – Judging Process, Schedule, and Team Preparation**

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

### **7.4.1 – Judging Process**

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At the *FIRST* Tech Challenge Championship Tournament events, there will be three parts to the judging process: 1) interview with judges, 2) evaluation performances, 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. The Engineering Notebooks will be provided to the judges prior to the team interviews.

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

Teams are asked to bring their robot to the judge interview. This is the best chance for teams to explain and demonstrate their robot design to the judges in a quiet and relaxed environment.

### **7.4.2 – Judging Schedule**

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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 target throughout the event, we require that all teams arrive at an adjacent queuing area five minutes before their scheduled interview.

### **7.4.3 – Team Preparation**

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Teams are encouraged to use the award guidelines to self assess where they are within an award category and help them establish higher goals. These guidelines will be the same ones used by the



judges during each *FIRST* Tech Challenge event, and at the *FIRST* Tech Challenge World Championship.

Remember, this is the team's opportunity to highlight how they rallied as a team around the robot; the technical knowledge they gained along the way; and how this experience has affected the members and mentors individually and as a team. Judges will want to hear from team member representatives and 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.

The mentors' contribution during the judging process will be kept to a minimum, however, the judges will like 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 with minimum direct assistance from the mentors will be evaluated during the team interview.

### **7.5 - *FIRST* Tech Challenge Championship Event Eligibility**

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

For the 2008 season, *FIRST* Tech Challenge teams will need to earn their way to the *FIRST* World Championship. Eligibility is earned by your performance on and off the field. The criteria for eligibility to the event will be announced later in the season. Teams will still be responsible for their own entry fees, lodging, and travel costs to the *FIRST* World Championship.



Section  
**8**



# Team Resources

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## Section 8 – Team Resources

### 8.1 – Overview

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

### 8.2 – FIRST Contact Information

You can reach the *FIRST* Tech Challenge staff by phone at (800) 871-8326 or e-mail at [FTCteams@usfirst.org](mailto:FTCteams@usfirst.org). The office is open Monday through Friday from 8:30 a.m. to 5:00 p.m., EST. Be sure to provide your team number in your message and leave contact information. Refer to the information below for the appropriate resource.

### 8.3 – Getting Answers to Your Questions

For general information and questions regarding the *FIRST* Tech Challenge, please send an e-mail request to [FTCteams@usfirst.org](mailto:FTCteams@usfirst.org).

For questions regarding the *FIRST* Tech Challenge *FIRST Face Off!* game, please have your team leader log into the TMS (Team Information Management System) to see your FTC team forum login under the 'What's New' information once your team has registered and paid with the *FIRST* Tech Challenge.

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

The free forum account needs to be registered and activated in order to ask official game questions. The FTC Interactive Manual and Game Q&A is accessed directly at <http://forums.usfirst.org/forumdisplay.php?f=26> or by browsing to [forums.usfirst.org](http://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.

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

Website	Description
<a href="http://www.usfirst.org/community/FTC/default.aspx?id=968">www.usfirst.org/community/FTC/default.aspx?id=968</a>	FTC information, FAQs, and team resources
<a href="http://forums.usfirst.org">forums.usfirst.org</a>	FTC Game Q&A and Interactive Manual
<a href="http://www.ftctraining.com">www.ftctraining.com</a>	NXT-G, Labview, and RobotC tutorials

### 8.4 – Technical Support

It is in the spirit of *FIRST* to bring the technical knowledge of an engineer to high school students to broaden their awareness and knowledge of the engineering world. There are many online resources to find help with the TETRIX™ Robotics Design System as well as many examples of the versatility of the kit. Please email [ftcteams@usfirst.org](mailto:ftcteams@usfirst.org) for more help or information.

## 8.5 – Team Development Support

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

## 8.6 – Using the *FIRST* and FTC Logos

We encourage teams to develop and promote team identity. It is a great way to help *FIRST* judges, announcers, and audiences recognize your team at the competition, and it is also a way to help 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 <http://www.usfirst.org/community/resourcecenter.aspx?id=746>. 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 Marian Murphy, [mmurphy@usfirst.org](mailto:mmurphy@usfirst.org), Marketing and Promotion.

**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 Marian Murphy at [mmurphy@usfirst.org](mailto:mmurphy@usfirst.org).

Section

# 9



# Robot Inspection Guidelines

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## Section 9 – Robot Inspection

### 9.1 – Overview

This section describes Robot Inspection for the *FIRST* Tech Challenge 2008-2009 competition, *FIRST* Face Off. It also lists the inspection definitions and inspection rules.

### 9.2 – Description

The *FTC robot* will be required to pass a hardware and a software 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 copy of the official FTC “Robot Inspection Sheet” is located in this section. The “Robot Inspection Sheet” should be used as a guide to pre-inspect the robot.

### 9.3 – Definitions

*FIRST Tech Challenge (FTC) robot* – An operator controlled and/or autonomous programmed vehicle designed and built by a *FIRST* Tech Challenge team to perform specific tasks while competing in the FTC *FIRST* Face Off. The FTC robot can be constructed using only official FTC Competition kit components as defined in Section 4.2 <R5>a., and additional components approved for the FTC *FIRST* Face Off competition as defined in Section 4.2 <R5>b. No other parts will be allowed on the vehicle. Prior to participating in the competition, each *FTC robot* will be required to pass an inspection.

*FTC Robot Sizing Box* – A box used during *FTC robot* inspection that has interior dimensions 18 inches (45.72cm) wide by 18 inches (45.72cm) long by 18 inches (45.72cm) high. The *FTC robot* must fit within the box without exerting ANY force on the box walls or ceiling. (i.e. the robot cannot be held inside the constraints by the box itself) to pass inspection.

### 9.4 – Inspection Rules

<I01> FTC teams must submit their *FTC robot* for inspection prior to participating in practice rounds. At the discretion of the FTC Lead Inspector, the *FTC robot* may be allowed to participate in practice rounds before passing inspection.

<I02> The team’s *FTC robot* must pass inspection before being allowed to compete in Qualification Rounds. Noncompliance with any *FTC robot* design, construction rule, or programming requirements may result in disqualification of the robot at a FTC event.

<I03> The FTC Official Team Number must be displayed on the *FTC robot* prior to inspection as defined in Section 4.2 <R10> .

<I04> *FTC robot* construction is constrained by the number of Official FTC Competition Kit components a team may use as defined in Section 4.2<R5> a. There is not a specified *FTC robot* weight constraint.

<I05> The maximum size of the *FTC 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 *FTC robot* must fit within a *FTC Robot Sizing Box* that has the following inside surface dimensions: A flat, level base 18 inches (45.72cm) x 18 inches (45.72cm), and a height of 18 inches (45.72cm). The *FTC robot* must be self-supporting while in the *FTC Robot Sizing Box*.

<I06> The starting configuration of the *FTC robot* at the beginning of a match must be the same as a *FTC robot* configuration inspected for compliance, and within the maximum allowed size.

<I07> *FTC robot* designs having more than one possible starting configuration, the largest possible configuration must be used during size inspection.

<I08> When an FTC team makes a modification to improve performance or reliability of their *FTC robot*, the team may request a re-inspection of their robot by an FTC Inspector.

<I09> FTC Inspectors evaluate *FTC robots* to insure each *FTC robot* has been designed to operate and function safely. The *FTC robot* must be designed for safe operation and handling. Specific safety rules and limitations apply to the design and construction of an *FTC robot* as defined in Section 2.4.3 <S01>.

<I10> An *FTC robot* is deemed successfully inspected when all items listed on the official FTC “Robot Inspection Sheet” have been recorded as passed by an FTC Inspector.

# Competition Inspection Checklist

Team Number: \_\_\_\_\_

Time of Inspection: \_\_\_\_\_

Pass/Fail: \_\_\_\_\_

Inspection Type:     \_\_\_ Initial                     \_\_\_ Mandated                     \_\_\_ Random

<b>Size Inspection</b>		
Robot fits within the Sizing Box (18" x 18" x 18") without exerting force on box sides or top		R4
<b>Overall Inspection</b>		
Team Number is visible from 2 sides, is written in 3" tall, 3/4" stroke on a contrasting background		R10
Robot does NOT contain any components which will be intentionally detached on the playing field		R3
Robot does NOT contain any components that could damage the playing field or other robots		R3
Robot does NOT contain any sharp edges or corners		R3
Robot poses NO obvious unnecessary risk of entanglement		R3
NXT battery can be easily removed without disassembly		R11
USB port is easily accessible for rapid registration		R11
Robot Flag Holder is present and adequately holds the flag during normal robot operation		R12
ALL Decorating Components on the Robot NOT meeting FTC Inspection Criteria are NON FUNCTIONAL		R5
<b>Parts Inspection - Official Tetrix Components</b>		
ALL Robot components are (or IDENTICAL to) OFFICIAL Tetrix Products or Vex Hardware		R5
FTC Robot does not utilize any of the Packaging materials, or materials other than those listed		R5
Robot has only (1) NXT controller		R5
Robot uses maximum of three (3) NXT Motors		R5
Robot uses maximum of four (4) 12V DC drive motors		R5
Robot uses a maximum of six (6) servos (Hi Tec, HS-475HB)		R5
Robot uses one (1) official NXT rechargeable battery pack or six (6) AA batteries (not both)		R5
Robot uses one (1) official FTC 12 V DC NiMH battery		R5
<b>Additional Parts Inspection</b>		
Robot contains no more than 12"x24"x1/10" thick polycarbonate		R5
Robot contains no more than 12"x24"x1/16" thick aluminum		R5
Robot contains no more than 12"x15" of Non-Slip Pad		R5
Robot contains only the Lego parts included in the FTC Competition Kit		R5
Robot contains Vex structural metal. NO Vex electrical components or linear slide pack		R5
<b>Construction Inspection</b>		
NO electrical components have been modified from their original state		R9
NO method of attachment NOT provided by the Tetrix or Vex Design System		R9
If thread locker is used, it is used for securing screws & fasteners ONLY		R9
<b>Software Functionality Check</b>		
Robot Contains the FTC Master Code, and runs autonomously for the first 30 seconds after transmitter link-up		

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 2008-2009 FIRST Tech Challenge have been abided by.

\_\_\_\_\_  
Inspector

\_\_\_\_\_  
Team Student Representative

