Game Manual
"Half-Pipe Hustle"

2005 - 2006
Pilot Season

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1.1 OVERVIEW

This chapter provides an introduction to *FIRST* and the *FIRST* Vex™ Challenge pilot 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 (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 non-profit organization.

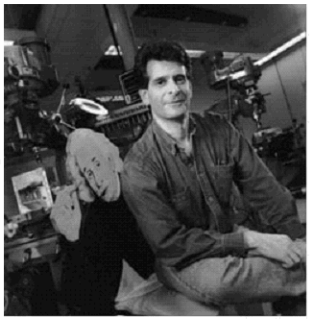
A volunteer-driven organization, *FIRST* is built on partnerships with individuals as well as businesses, educational institutions, and government. Some of the world's most respected companies provide funding, mentorship time and talent, and equipment to make *FIRST's mission* a reality. As a team coach, you join over 40,000 committed and effective volunteers who are key to introducing over 73,000 youth to the joy of problem solving through engineering.

FIRST already provides two well-known programs, the *FIRST* Robotics Competition (FRC) for high-school-aged students and *FIRST* LEGO® League (FLL) for 9 to 14 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 all *FIRST* robotics programs team coaches.

Since 1992, the *FIRST* Robotics Competition (FRC) has challenged high-school students – working with professional mentors – to solve an engineering design problem in an intense and competitive way. The program is a life-changing, career-molding experience – and a lot of fun. In 2005, the competition reached more than 22,000 students on close to 1,000 teams in 30 regional competitions and one Championship event. Our teams come from Brazil, Canada, Ecuador, Israel, Mexico, the United Kingdom, and almost every U.S. state.

"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 VEX CHALLENGE

FIRST is piloting a new initiative – the *FIRST* Vex™ Challenge. RadioShack is sponsoring the *FIRST* Vex Challenge and launched the Vex Robotics Design System at the 2005 *FIRST* Championship in Atlanta, Georgia. The Vex Robotics Design System challenges students' creative problem-solving skills by enabling them to build robots that do amazing things. Vex allows students to design and construct robotic devices which can be autonomously programmed or radio controlled to perform various tasks that expand the boundaries of experimental intelligence.

The *FIRST* Vex Challenge grew out of the existing *FIRST* Robotics Competition and the *FIRST* Robovation platform. *FIRST*, RadioShack, and Innovation First collaborated to develop an improved version of the *FIRST* Robovation kit. The new kit was significantly upgraded and is called the Vex Robotics Design System. RadioShack has licensed the *FIRST* name and logo for use with the Vex Robotics Design System. *FIRST* creates the game/challenge and teams can use the Vex Robotics Design System kit to participate.

FIRST Vex Challenge teams purchase the Vex starter kit, battery pack, and programming kit directly from RadioShack. The kits provide a level starting point for all teams. The games rules and regulations are provided by *FIRST*. Students must maintain an Engineering Notebook to track their progress, successes, and disappointments throughout their design process. When you bring dedicated, enthusiastic students and a mentor together, they will produce a wide range of amazing machines that are ready for competition.

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.

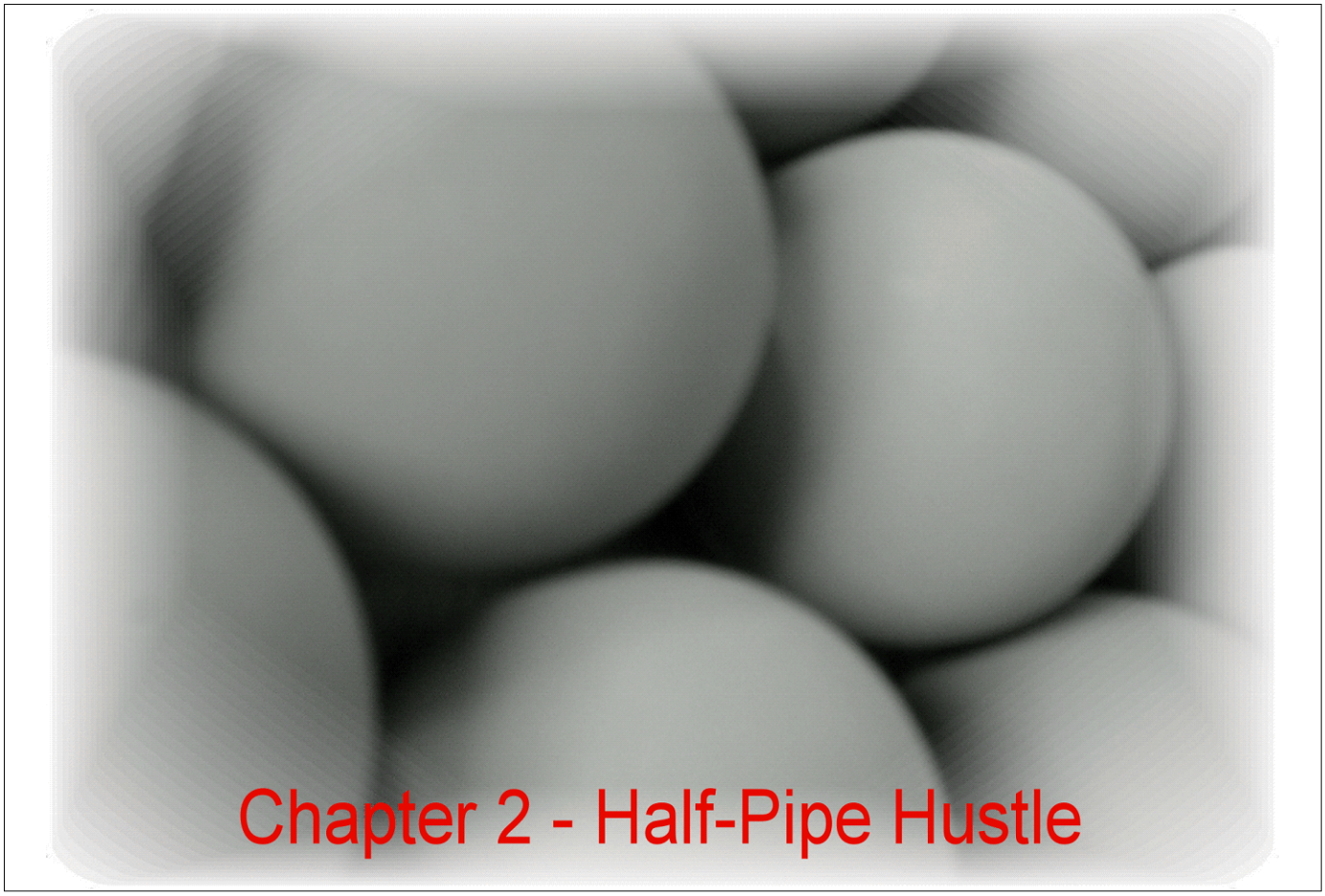
In the long run, gracious professionalism is part of pursuing a meaningful life. One can add to society and enjoy the satisfaction of knowing that you have acted with integrity and sensitivity. That's good stuff!"

The *FIRST* Vex 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 VEX CHALLENGE – 2005-2006 PILOT SEASON

FIRST Vex Challenge teams will participate in the *Half-Pipe Hustle* for 2005-2006. The game is made up of two distinct match types – operator-controlled and autonomous. While both are played on similar fields with identical objects, their scoring and play style differ. Each tournament features alliances comprised of two teams playing from opposite ends of the playing field. At the start of the match, operators will have control of their robots and must work together to obtain and score as many balls as possible before time runs out.

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 Vex robot to compete in one of six regional tournaments, and perhaps the championship, where they celebrate their accomplishments with other *FIRST* Vex Challenge teams, family, and friends. After the hard work and a lot of fun, 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.



Chapter 2 - Half-Pipe Hustle

2.1 OVERVIEW

This chapter describes the *FIRST* Vex™ Challenge game for the 2005-2006 pilot season, called *Half-Pipe Hustle*. It also lists the game definitions and game rules.

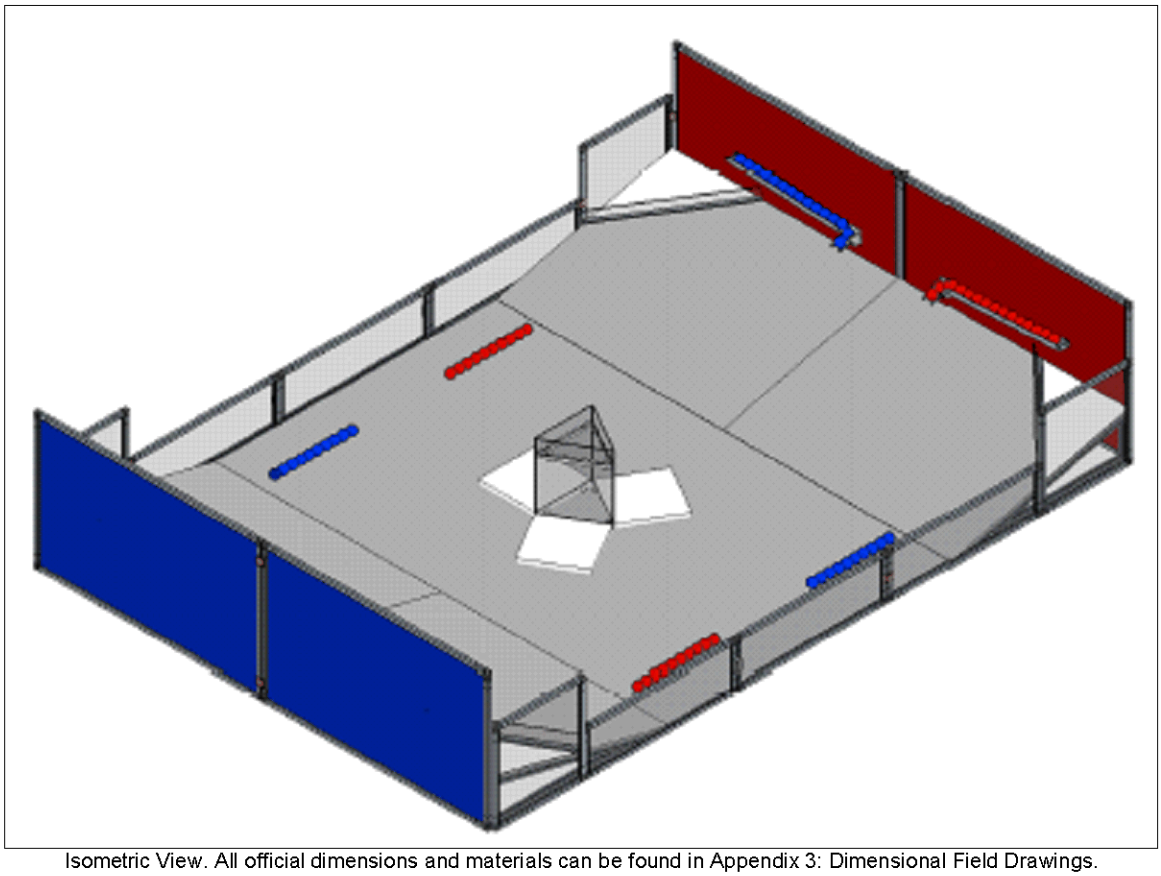
2.2 GAME DESCRIPTION

Half-Pipe Hustle is split into two distinct match types, operator-controlled and autonomous. While both are played on similar fields with identical objects, their scoring and play style differ.

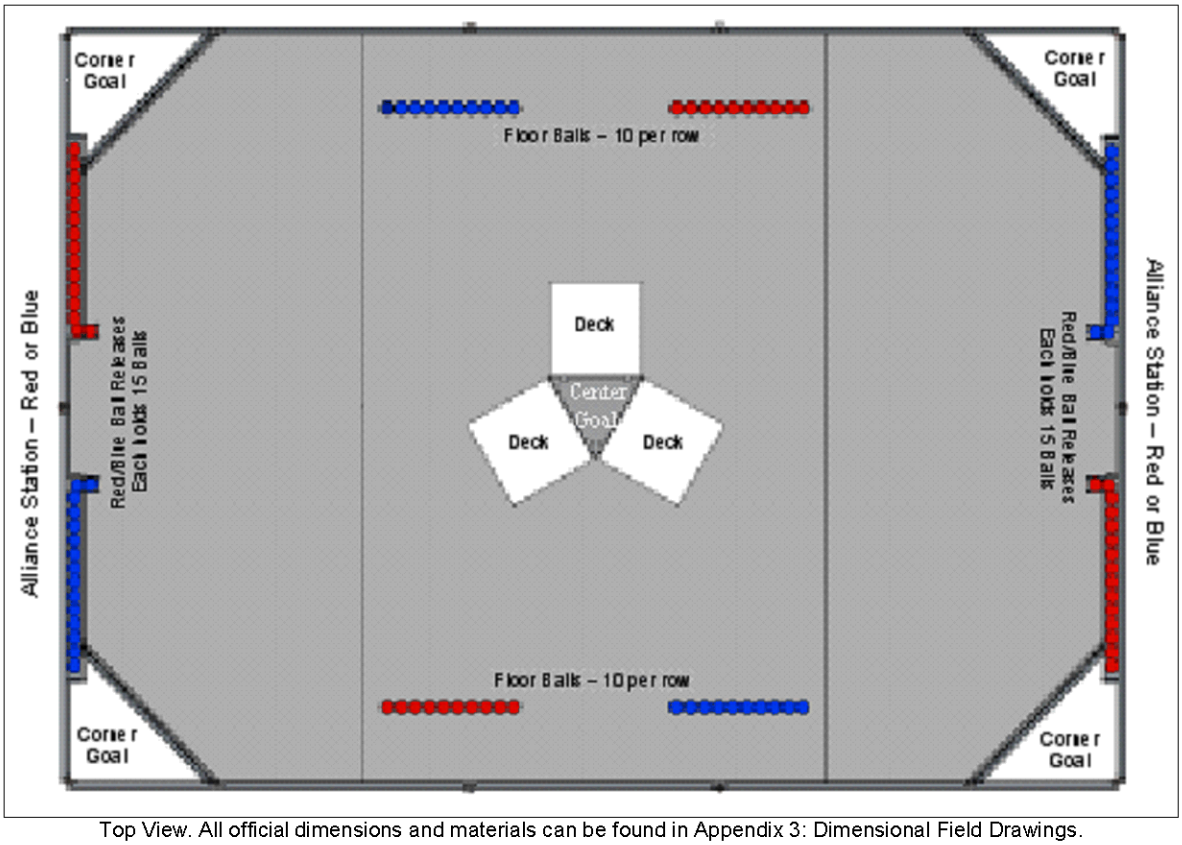
Operator-Controlled Matches

Operator-controlled 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 opponent ALLIANCE by placing your ALLIANCE's colored BALLs into GOALs, owning GOALs by scoring more BALLs than your opponent in each GOAL, and/or having one or both ROBOTs from an ALLIANCE on a DECK at the end of the match.

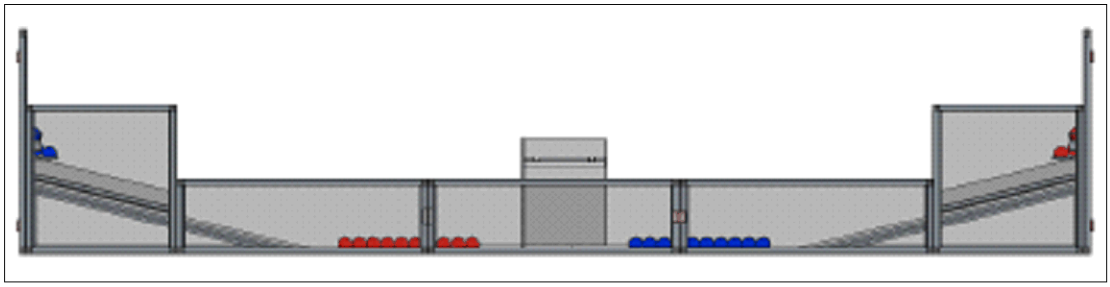
There are 50 red BALLs and 50 blue BALLs available to each ALLIANCE. Twenty of these BALLs will be found in two rows of 10 BALLs each, 12 inches from the wall.



Isometric View. All official dimensions and materials can be found in Appendix 3: Dimensional Field Drawings.



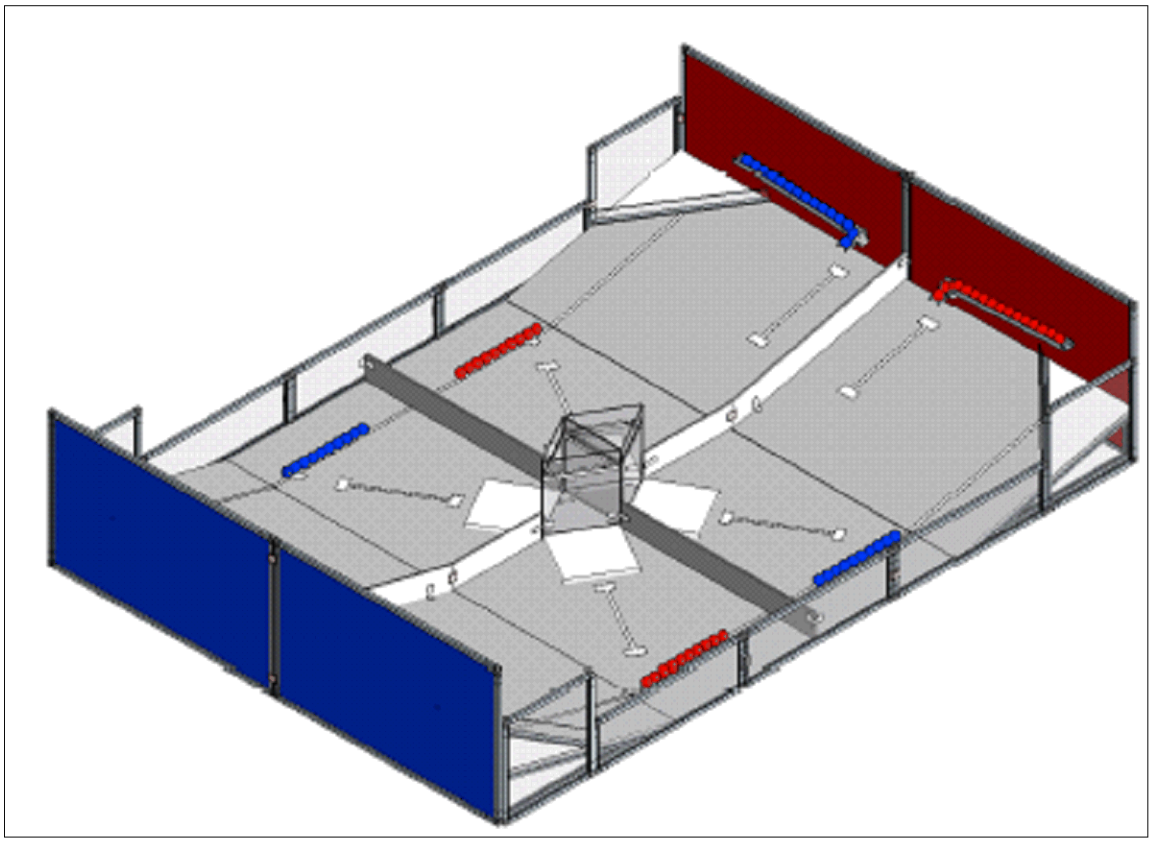
Top View. All official dimensions and materials can be found in Appendix 3: Dimensional Field Drawings.



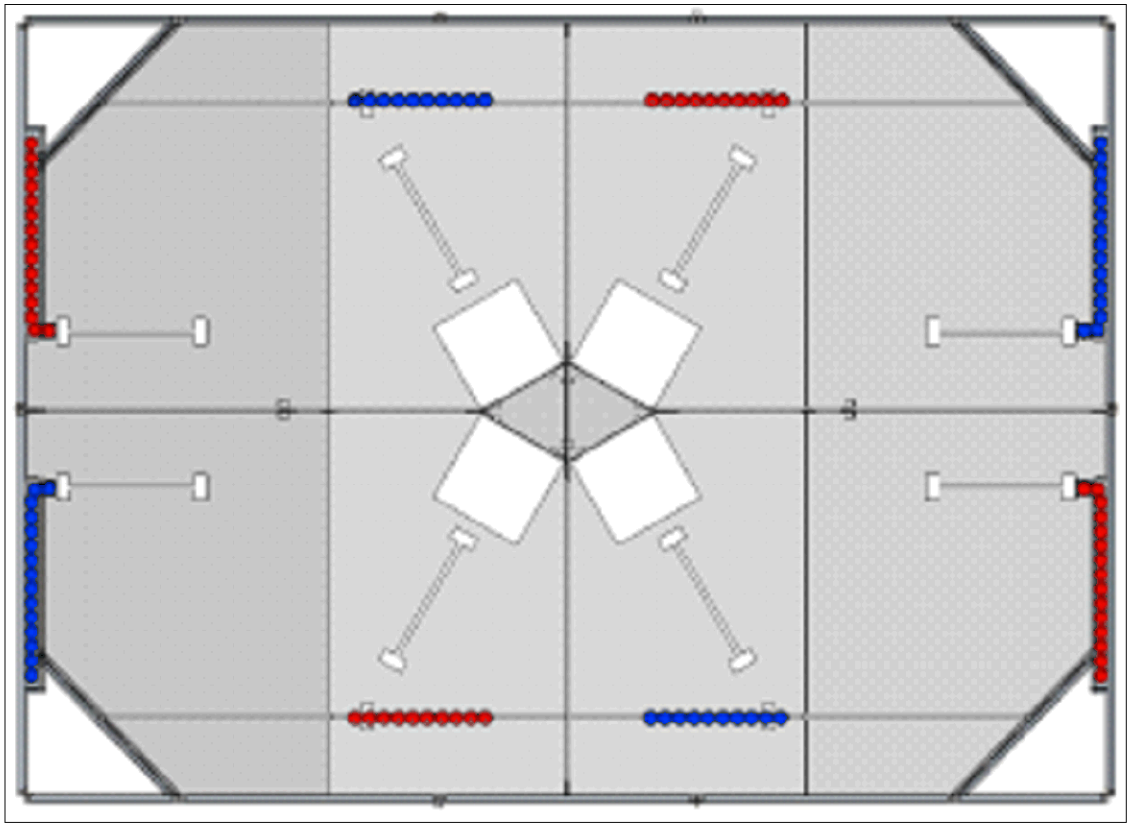
Side View. All official dimensions and materials can be found in Appendix 3: Dimensional Field Drawings.

Autonomous Matches

AUTONOMOUS MATCHES are played on a field very similar to the one used in operator-controlled matches. The major differences lie in the segmentation of the field into quadrants and modifications made to the center GOAL to facilitate the separation of ROBOTs while matches are being run. Each team earns its own score (there are no ALLIANCEs in AUTONOMOUS MATCHES) and plays on a quadrant of the field attempting to score the most cumulative points over a series of matches. Without operator control, the ROBOTs must place BALLs in the goals, and/or navigate to the DECK to score points.

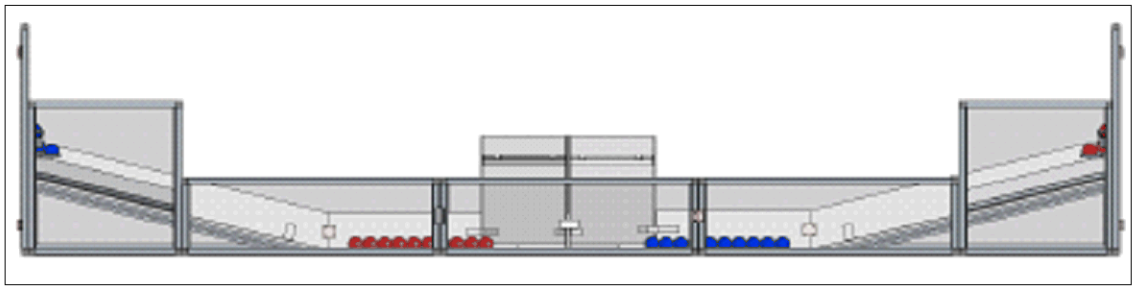


Isometric View. All official dimensions and materials can be found in Appendix 3: Dimensional Field Drawings.



Top View. All official dimensions and materials can be found in Appendix 3: Dimensional Field Drawings.

Note: *The above field will have white lines for use during the* AUTONOMOUS MATCHES. *Refer to appendix 3 for the exact location and dimension of these lines.*



Side View. All official dimensions and materials can be found in Appendix 3: Dimensional Field Drawings.

2.3 GAME DEFINITIONS

ALLIANCE – A pre-assigned grouping of two teams that work together for a given OPERATOR-CONTROLLED MATCH.

ALLIANCE STATION – The region behind the player station wall where the DRIVERs and COACH stand during any match.

AUTONOMOUS MATCH – This match consists of two consecutive, 30-second AUTONOMOUS PERIODs for a total of 1 minute of playing time. Between each period, teams will reset their ROBOTs by returning them to their respective starting positions.

AUTONOMOUS PERIOD – A 30-second time period in which the ROBOTs operate and react only to sensor inputs and to commands programmed by the team into the onboard ROBOT control system. Human control of the ROBOT is not permitted during this time. During this period, ROBOTs may perform any activities that would be permissible when operated under human control.

BALL – The primary playing object, which is a regulation-size racquetball measuring 2.25 inches in diameter.

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

DECK – One of the three raised platforms surrounding the center GOAL.

DRIVER – A high school aged team member responsible for operating and controlling the ROBOT and wearing a "DRIVER" badge.

GOAL – One of the five field structures into which teams can place BALLs. All are triangular-shaped. Four of the structures are in the corners of the field and one is in the center of the field.

OPERATOR-CONTROLLED MATCH – This match is two minutes long. Before the start of the match, all DRIVERs and COACHES must be standing in their respective ALLIANCE STATION. Once started, DRIVER station controls will be activated and DRIVERs may remotely control and operate their ROBOTs for the full duration of the match.

OWNING A GOAL – A GOAL is OWNED by an ALLIANCE if the number of BALLs SCORED (corresponding to the ALLIANCE'S color) is greater than the number of BALLs SCORED in the same GOAL by the opposing ALLIANCE. A GOAL is not considered OWNED if the number of BALLs SCORED in a GOAL by each ALLIANCE is equal.

ROBOT – Anything (which has passed inspection) that a team places on the field prior to the start of a match.

SCORED – A BALL is SCORED in a GOAL if some part of the BALL is within the two-dimensional space defined by the edges of the GOAL, and not touching a ROBOT of the same ALLIANCE.

Note: *A GOAL extends infinitely perpendicular to the playing field surface within the GOAL boundaries.*

2.4 GAME RULES

Scoring in Operator-Controlled Matches

- A BALL is worth one point if SCORED in any GOAL for the ALLIANCE of the corresponding color.
- OWNERSHIP of a corner GOAL is worth five points for the OWNING ALLIANCE.
- OWNERSHIP of the center GOAL is worth ten points for the OWNING ALLIANCE.
- A ROBOT fully on a DECK, without contacting the foam playing field surface, is worth five points for the corresponding ALLIANCE.

Scoring in Autonomous Matches

- Each BALL in the corner GOAL is worth one point for the team operating in that quadrant.
- Each BALL in the center GOAL is worth two points for the team operating in that quadrant.
- A ROBOT fully on a DECK, without contacting the foam playing field surface, is worth five points for that team.

Safety Rules

<S01> 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 take the field again.

<S02> If a ROBOT goes completely out-of-bounds (outside the playing field), it will be disabled for the remainder of the match.

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

General Rules

<G1> At the beginning of any match, each ROBOT must not exceed the starting dimensions outlined in Chapter 4: Robot Rules, of 18 inches wide by 18 inches long by 12 inches 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 positioning the ROBOT.

<G2> At the beginning of each OPERATOR-CONTROLLED MATCH, the two ALLIANCE ROBOTs must be placed in one of the two starting positions located immediately in front of their ALLIANCE STATION adjacent to the corner GOALS. For the ROBOT to be legally in either of these starting positions it must be touching the corner GOAL.

a. ROBOTs may be positioned to start in either ALLIANCE starting position in any orientation as long as there is contact with the corner GOAL, but the DRIVER and COACH must set up under their assigned ALLIANCE position.

b. Prior to the start of each AUTONOMOUS PERIOD, a DRIVER may place one BALL in or on his/her team's ROBOT.

<G3> Each drive team shall include up to two DRIVERs and one COACH.

<G4> During an AUTONOMOUS MATCH, the DRIVERs and COACH must remain in the ALLIANCE STATION and cannot touch their controls.

<G5> In addition to the BALLs placed on the field prior to the start of the match, ROBOTs may retrieve additional BALLs at the auto-loading stations and introduce them into the game.

<G6> BALLs that leave the playing field are considered out of play. These BALLs will not be returned to the field and/or auto-loading stations.

<G7> In an OPERATOR-CONTROLLED MATCH, a BALL is not considered SCORED if it is being touched by a ROBOT on an ALLIANCE of the same color at the conclusion of play. The same rule applies in autonomous play for an individual ROBOT and its own BALLs.

<G8> A ROBOT cannot score on more than one DECK at a time. If a ROBOT is considered in scoring position on more than one DECK, the ALLIANCE will only receive points for ONLY one.

<G9> Pinning a ROBOT from an opposing ALLIANCE is not permissible. A ROBOT cannot pin (inhibit the movement of another ROBOT while it is in contact with one or more field elements) for more than five seconds. If a referee determines this rule to be violated, the offending ROBOT will be disabled for the match.

<G10> During an OPERATOR-CONTROLLED MATCH, the 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.

<G11> Scores will be calculated for all OPERATOR-CONTROLLED MATCHES and AUTONOMOUS PERIODS either immediately after the match or when all objects on the field come to rest.

<G12> ROBOTs may not intentionally detach parts during any match or leave multiple mechanisms on the field. If a detached component or mechanism is attached to a GOAL and prevents additional scoring of BALLs, the team will be disqualified. Multiple infractions may result in disqualification for the entire competition.

<G13> Strategies aimed solely at the destruction, damage, tipping over, or entanglement of ROBOTs are not in the spirit of the *FIRST* Vex Challenge and are not allowed. However, *Half-Pipe Hustle* 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.

<G14> ROBOTs must be designed to permit removal of BALLs from any grasping mechanism without requiring that the ROBOT have power after the match.

<G15> The surface finish of the rubber balls may bind or stick during the course of normal game play. This is not a field malfunction and will not be considered as grounds for a replay.

Chapter 3 - The Tournament

3.1 OVERVIEW

This chapter describes the tournament format. The *FIRST* Vex™ Challenge will be played in a tournament format. Each tournament will include practice, qualifying, and elimination type 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 PRACTICE MATCHES

Practice matches will be played in the morning during the team registration time until the drivers meeting begins. Practice will be allowed on both the operator-controlled and autonomous fields. Every effort will be made to equalize practice time for all teams, but it will be conducted on a first-come, first-served basis.

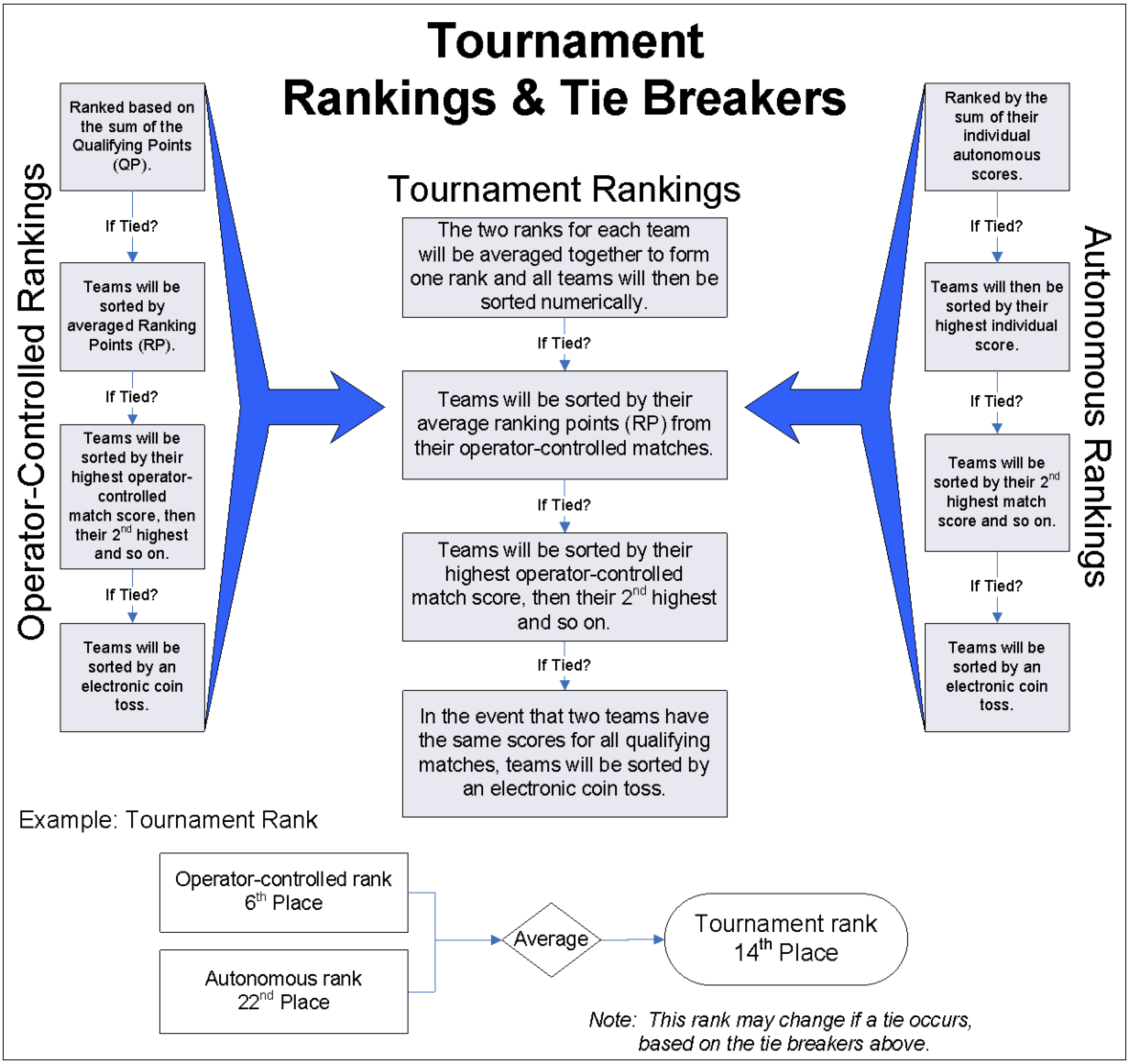
3.3 QUALIFYING MATCHES

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 – and your team's starting position for each match. This starting position is used to determine the placement of each team's robot, students, and coach around the playing field.
- The qualifying matches (both operator-controlled and autonomous) will be played on their designated fields starting immediately after opening ceremonies.
- Teams will be randomly assigned an alliance partner to compete against two randomly assigned opponents in each operator-controlled qualifying match played.
- All teams will play be scored on the same number of operator-controlled qualifying matches.
- Teams will also be randomly scheduled an equal number of autonomous qualifying matches.

Rankings

- At the conclusion of each operator-controlled match, qualifying points (QP's) will be issued:
    - Winning teams of an operator-controlled qualifying match receive two QP's.
    - Losing teams of an operator-controlled qualifying match receive zero QP's.
    - If an operator-controlled qualifying match ends in a tie, all four teams receive one QP.
- All teams in each operator-controlled qualifying match will also receive ranking points (RP's).
    - 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's (equal to the tie score).
    - If both teams on an alliance are disqualified, the teams on the winning alliance will be awarded their own score as their RP's for that match.
- For an operator-controlled 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 QP's and zero RP's.
- For an autonomous qualifying match, if the team's robot is NOT present on the field at the start of a match, that team is declared a "no show" and will receive zero points.

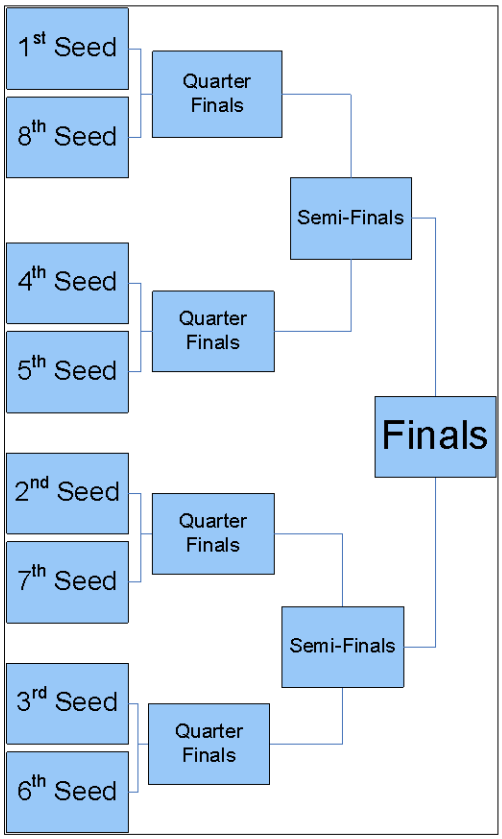


3.4 ELIMINATION MATCHES

- All elimination matches will be operator-controlled.
  - There is no autonomous play during the eliminations.
- 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.

Alliance Selection Process

- Every team will choose a student to act as team representative.
    - These representatives will proceed to the playing field at the designated time to represent their teams in the alliance draft.
- There will be eight alliances formed in the alliance selection.
- In order of tournament ranking, 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 rounds.



During matches, two teams from an alliance will play on the field. ***Any team, which 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.

Match Ladder

The elimination rounds will play in a ladder format as shown on the left side of the page.

Elimination Scoring

In the elimination rounds, teams do not get "qualifying points" (2, 1, 0); they get a win, loss or tie (W,L,T).

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.***

3.5 TOURNAMENT RULES

<T01> Referees have ultimate authority during the competition. THEIR RULINGS ARE FINAL!

a. The referees will not review any recorded replays.

<T02> 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.

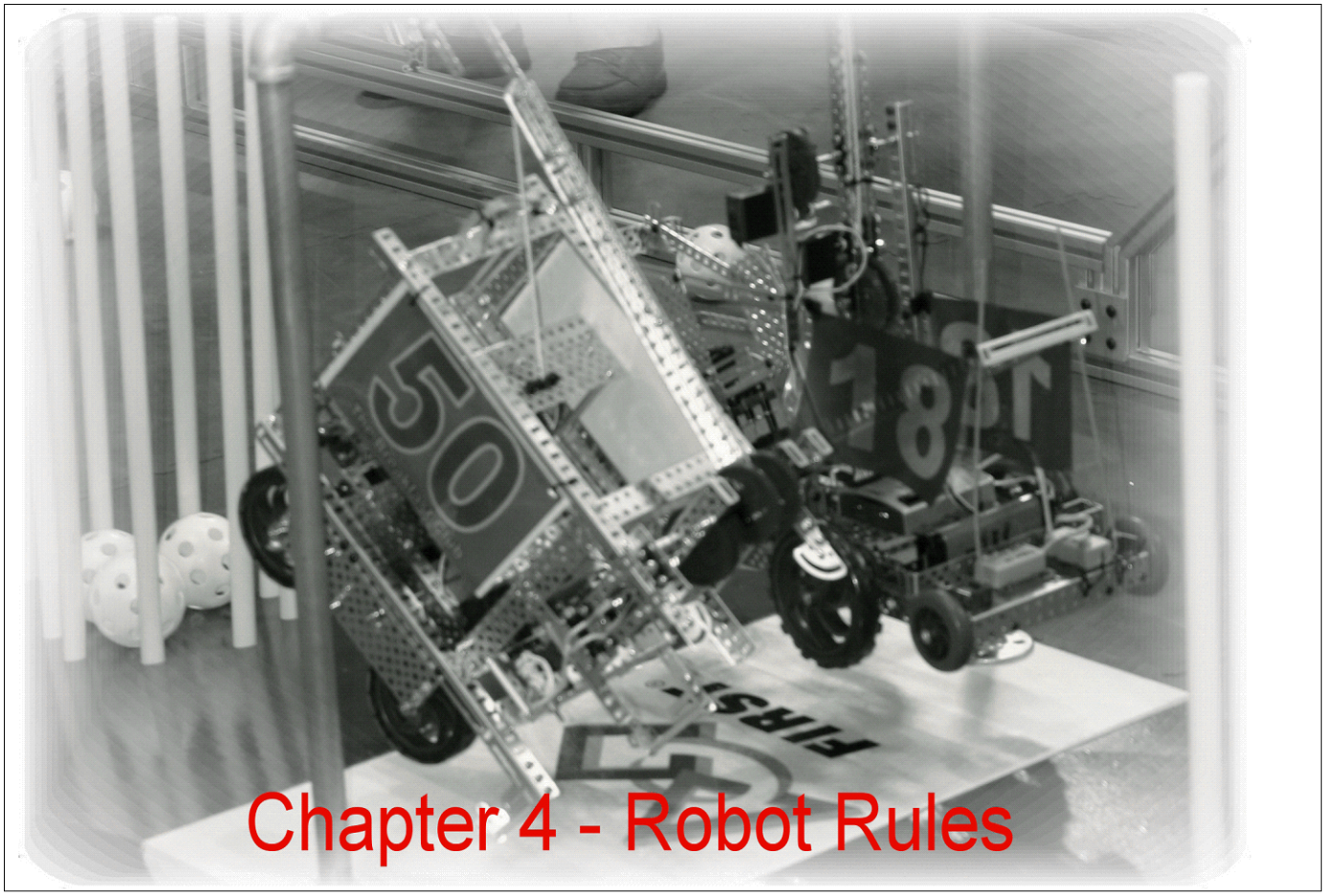
a. If a robot cannot report for a match, at least one member of the team should report to the field for the match.

<T03> During the elimination rounds, alliances will have at least four minutes between scheduled matches.

<T04> Special clothing and/or equipment will only be allowed on the playing field for those who demonstrate a need based on a physical disability.

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

a. Teams are responsible for providing their own safety glasses at each event.



Chapter 4 - Robot Rules

4.1 OVERVIEW

This chapter provides rules and requirements for the design and construction of your robot. A *FIRST* Vex™ Challenge robot is a remotely operated vehicle designed and built by a *FIRST* Vex Challenge student team to perform specific tasks when competing in the *Half-Pipe Hustle*. Prior to competing in competition, each robot will have to pass an inspection. Refer to Appendix 1 for the 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* Vex Competition. 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 FVC 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. Teams may be requested to submit to random spot-inspections by event personnel. Refusal to submit will result in disqualification.
c. 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 be barred from the playing field until they pass re-inspection.

<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 or interfere with other competing robots.
c. Those that pose an unnecessary risk of entanglement.

<R4> At the beginning of any match, the maximum allowed size of a robot is 18 inches (45.72 cm) wide by 18 inches (45.72 cm) long by 12 inches (30.48 cm) tall.
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. the robot cannot be held inside the constraints by the box itself.)
b. Robot may expand beyond this size 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 Official Vex Component may be used (except as limited below):
- Only one (1) Vex Microcontroller
- Up to eight (8) Motors or Servos (Any combination, up to eight)
- Only one (1) Battery Pack (from the Vex Power Kit)
- Only two (2) RF receivers
- The packaging, manual binders, Styrofoam, cardboard, plastic bags, etc. from the Vex kits are **NOT** included and **CANNOT** be used for robot construction. Only the Vex parts themselves are allowed.

Note: *Official Vex products are ONLY available from RadioShack (consumer products) and VexLABS (experimental products). Products on the VexLABS web site will denote what is available for use in this competition, not all products may apply.*

b. The following additional components from VexLABS may also be used:
- Five (5) elastic bands, #32 size only
- 24" of 1/8" Nylon Rope
- 6" of 3/4" Wide Velcro
- 12" x 15" of Non-Slip Pad

c. No additional components may be used!

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

<R7> During inspections if there is a question about whether something is an Official Vex Component, a team will be required to provide documentation to an inspector, which proves the component's source.

<R8> No more than two transmitters may control a single robot during the tournament. No modification of the Vex transmitter is allowed of ANY kind.

<R9> Parts may NOT be modified as follows:

a. Motors, extension cords, sensors, controllers, battery packs, and any other electrical component of the Vex Robotics Design System may NOT be altered from their original state in ANY way.
b. Welding, soldering, brazing, gluing or attaching in any way that is not provided in the kit will NOT be allowed.
    i. Hardware may be secured using Loctite or a similar thread-locker.
        1. This may be used for securing hardware ONLY.

<R10> Robots must display their team number (numerals only, i.e. "229").

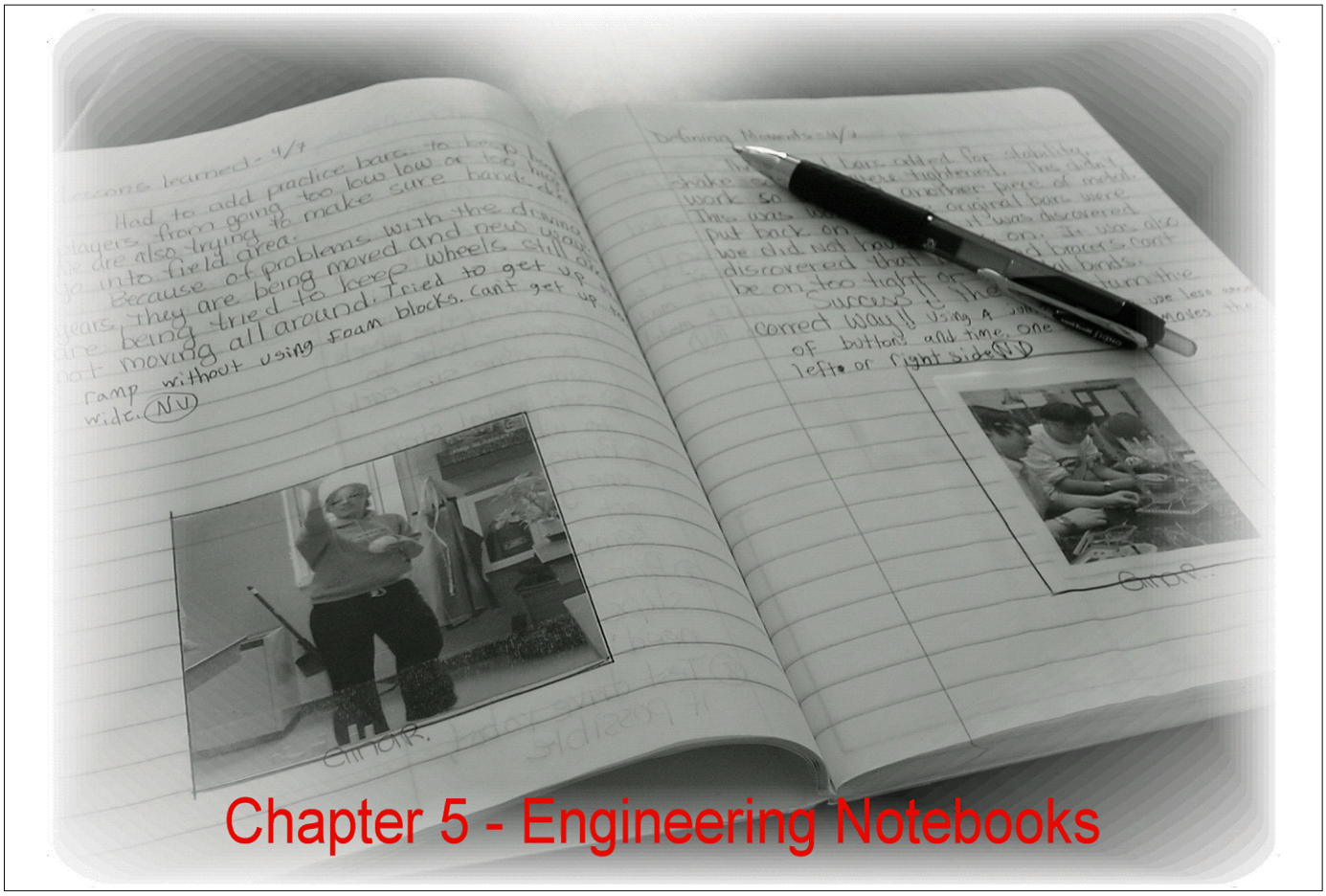
a. The judges, referees, and announcers must be able to easily identify robots by team number.
b. Team number must be visible from two sides of the robot (180 degrees apart).
c. The numerals must each be at least three inches high, at least in ¾-inch stroke width and in a contrasting color from their background.
d. Teams will be provided with two red or blue magnets that must be visible from two sides of the robot (180 degrees apart). Teams need to provide an appropriate surface on which these can be mounted.

<R11> Robot receiver must be accessible by competition personnel.

a. The radio crystal must be easily removed from the robot without any robot disassembly.
b. Crystals will be provided to each team for each match.

4.3 AUTONOMOUS PROGRAMMING GUIDELINES

The procedures that will be used to govern autonomous action will be released in a team update.



5.1 OVERVIEW

This chapter 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* Vex™ Challenge Engineering Notebook.

5.2 WHAT IS AN ENGINEERING NOTEBOOK

One of the goals of *FIRST* and the *FIRST* Vex 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 Chapter 7: Awards & Judging Criteria and the guidelines in the Appendix 2 for more details on how your Engineering Notebook will be judged.*

5.3 THE NOTEBOOK

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 of 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* Vex 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 "Ahas!", obstacles and each team member's thoughts throughout the journey. So here are the guidelines:

- Write EVERYTHING down!!
- Engineering Notebooks should be organized enough to have an outsider understand your team and your journey.
- 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* Vex 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.
- At the start of each day the team meets, start a fresh page. 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 something was there if 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 10-12 best moments as a team. Judges will use these pages as their preliminary review of your notebook.
- The more interaction your team has with mentors, engineers, or virtual engineers (see below), the better!! Remember to note each discussion or online discussion that your team has with a Virtual Engineer.
- Don't be afraid to customize your Engineering Notebook to reflect your team's personality! At the end of the season, this notebook will be a great piece of memorabilia for your team.

5.6 VIRTUAL ENGINEER

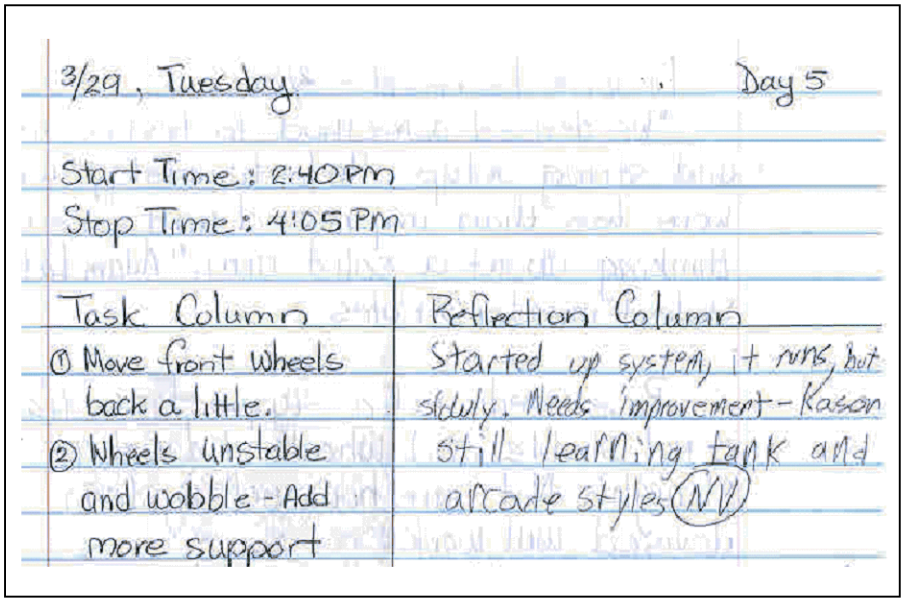
It is in the spirit of *FIRST* to bring the technical knowledge of an engineer to high school students to broaden their awareness and knowledge of the engineering world. Through the *FIRST* Vex Challenge, not every team will have direct access to an engineer for support, so *FIRST* will be offering a Virtual Engineer. These virtual engineers will be available on the web through a forum for those students without engineering support for their team or students in need of some guidance through the design or programming process.

http://www.vexlabs.com/forum/

Each conversation with your real life or virtual engineer should be documented in your Engineering Notebook. These conversations will greatly benefit your team and aid in solving any mechanical or design dilemmas. Please visit the above website for more information on how to post and how to use the Virtual Engineer forum.

5.7 NOTEBOOK EXAMPLES

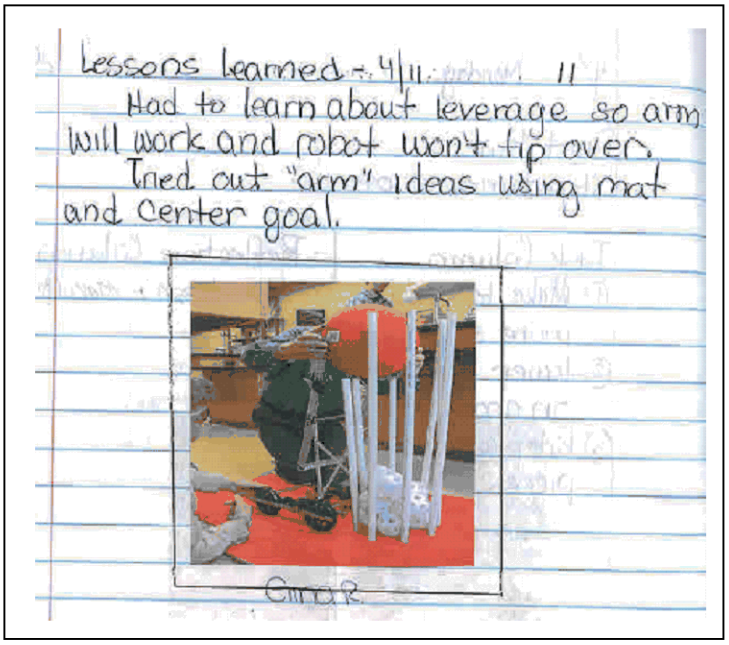
The following examples were taken from FVC Team 2 C.H.A.O.S. from Manchester High School Central in Manchester, New Hampshire. They were the 2005 Winners of the *FIRST* Vex Challenge Think Award for their outstanding Engineering Notebook.



3/29, Tuesday. Day 5

Start Time: 2:40PM
Stop Time: 4:05 PM

Task Column	Reflection Column
① Move front wheels back a little.	Started up system, it runs, but slowly. Needs improvement - Kasan still learning tank and arcade styles (NV)
② Wheels unstable and wobble - Add more support	



Lessons learned - 4/11.
Had to learn about leverage so arm will work and robot won't tip over.
Tried out "arm" ideas using mat and center goal.

6.1 OVERVIEW

This chapter 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 AGENDA – REGIONAL EVENT

Schedules will be available through an update to teams prior to their regional event.

6.3 COURTESIES AND RULES

You will hear the expression *Gracious Professionalism* often throughout your involvement in the *FIRST* Vex™ 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 is. 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. We are trying to encourage support from our audiences at the regional events and the championship. We need continued and growing support from outside sources. Please help to make them comfortable.

Bands:	No live bands in the audience or pit.
Battery Safety:	Charge in an open, well-ventilated area.
Fire Extinguishers:	Located at the pit administration station and on the playing field.
Food:	You cannot bring food on site… at all. Not even as a promotion. Do not provide teams with candy, water, fruit, soft drinks, etc. This is to promote good will and the spirit of partnership with venues.
Music/Noise:	No loud music, audio systems, whistles, banging sticks, blow horns, etc. They interfere with announcements. They prevent teams from hearing important announcements, can be annoying, and can cause hearing loss. Power may be shut off and/or radio/cd player, noise makers confiscated.
Phone lines:	No free phone lines for internet access… at all.
Robot Operation:	Robots in the practice area of the pit must be tethered to ensure that there not be any interference with the competition.
Team Safety Captain: **Safety Glasses:** **Running:** **Painting:**	Each team appoints a safety captain who will help maintain safety at events, especially in the pit. He or she will remind attendees about: 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. Teams are required to bring enough safety glasses/goggles to supply its team members and its guests. There is to be no running in the pit or in the competition arena. There will be no painting in the pit.
Sales:	Because of site regulations/contracts, *FIRST* cannot allow teams or individuals to sell items, such as T-shirts, pins, etc., at any events.
Seat Saving:	Not allowed, we need seats to get the public comfortable and interested.
Two-way radios:	These are not allowed in the pit or near the playing field since they may interfere with robot operation and cause accidents.

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.

Practice Rounds: The competition fields will be open to anyone who would like to practice before the opening ceremonies. Teams will only be allowed on the fields for practice during this time.

Judge's Interviews: There will be a ten-minute interview scheduled for every team to meet with the judge's throughout the event. Please have two student team representatives available, the entire team/robot are not required to attend.

Match List: The match list will be distributed by competition personnel to teams the day of the event.

Scouting: Teams often use the list for scouting other teams and their strategies. This is especially helpful when choosing alliances for the final rounds.

Early Matches: If your team is in any of the first four matches on 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.

Maintaining Schedule: The queue team will work together throughout the days 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 designates the end of the competition day.

6.5 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.

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 Chapter 8: Team Resources for information.

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.

7.1 OVERVIEW

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

In addition to winning points during the regional competition, the awards represent another positive way for mentors to instill important values like teamwork, creative and innovative engineering design processes, for teams to be recognized, and celebrate their hard work and preparations. **As you read the criteria for each award please make sure to use the Judges' Guidelines located in Appendix 2**. These judging guidelines are a part of the road map to success.

7.2 FIRST VEX CHALLENGE AWARD CATEGORIES

FIRST Vex Challenge Award

This peer and formally judged award will be given to the team that performs well in all categories, that impresses all other teams and who they would always want as an alliance partner and finally, the team the judges view that best exemplifies all components of the *FIRST* Vex Challenge philosophy. The team will be reviewed to have the following qualities:

- A team who is recognized by both peers and judges to demonstrate respect, gracious professionalism both for team members and fellow teams.
- A team who demonstrates good communications and teamwork skills within the team as well as with their alliances.

- A team that can communicate clearly about their robot design; its design impresses all *FIRST* Vex Challenge teams and judges; and the robot consistently performs well during matches

FIRST Vex Challenge *Amaze* Award

This judged award is given to the team that defies any award category. The judges will decide based on their own criteria.

FIRST Vex Challenge *Create* Award

This judged award is given to the team that has the most innovative and creative robot design solution to any and/or all specific field elements or components in the *FIRST* Vex Challenge.

- If the team developed a *FIRST* Vex Engineering Notebook, they should mark the journal entries that describe succinctly how the team arrived at their solution. (A *FIRST* Vex Engineering Notebook is not required to be judged for this award however, it is highly recommended.)
- Their design will be judged on the basis of design elegance, robustness, and the degree of "out of the box" thinking it reflects.
- Their design will may be judged on the basis of either the whole robot or some sub-assembly or component of the robot.
- Does not necessarily have to work all of the time during matches to be considered for this award.

FIRST Vex Challenge *Connect* Award

This award will be given to the team who receives the total highest points after the completion of the autonomous matches.

FIRST Vex Challenge *Think* Award

This judged award will be awarded to the team whose Engineering Notebook best reflects the "journey" the team took as they experienced the engineering design process during the build season. Teams will need to keep Engineering Notebooks describing the steps, brainstorms, designs, re-designs, successes, and "those interesting moments" when things were not going as planned.

- All teams MUST submit an Engineering Notebook to be considered for this award.
- The Engineering Notebook may be maintained by a single team member but MUST contain entries by all team members. However, entries will need to highlight the thoughts of various team members and mentors of the team.
- The notebooks should be organized, their processes, brainstorms and strategies well documented. **Teams should mark six entries** as good examples of the different types of experiences the team encountered including:
    - What the team experienced during the engineering design process,
    - The experience of the team work and communication during the building the robot,
    - Identify some of the defining and/or interesting moment(s), obstacles and Aha(s),
    - What are some of the lessons learned from the entire experience,
    - Drawings and descriptions of the robot during the different stages of design

- The Engineering Notebooks are not production documents. They are intended to capture the engineering process as it happens and they should reflect the team's personality and spirit.

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

At registration, teams will be given a *FIRST* Vex Challenge Engineering Notebook Envelope to fill out as well as to place their engineering notebooks in when submitting it to the *FIRST* Vex Challenge Pit Administration desk at the beginning of the regional competition.

FIRST Vex Challenge Winning Alliance Award

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

7.3 JUDGING PROCESS, SCHEDULE, AND TEAM PREPARATION

The schedules at the *FIRST* Vex Challenge competitions may vary from site to site therefore 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. Team preparation, the judging process, and schedule are outlined in this section.

Judging Process

At the *FIRST* Vex Challenge pilot events, there will be two parts to the judging process: 1) interview with judges and 2) and evaluating performances. Each team will have a "fact finding" discussion/interview with a panel of two judges. No awards will be determined on the basis of this interview alone. Judges will use a set of guidelines (see Appendix 2) to assess each team.

After the completion of the initial interviews and evaluations on team and robot performances during matches, all of the judges 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 will be completed during the elimination matches.

Judging Schedule

The judging generally will take place in a separate area(s) away from the competition and pit. This location is intended to facilitate a conversation where judges and participants can hear and understand each other well. Teams will follow the schedule that outlines team interview times and locations. If possible these interview schedules may be posted on a web site prior to the actual day of the competition. Teams will be instructed where to find this information if it is available. Regional events that do not pre-schedule teams will issue schedules to teams when they check-in the morning of the tournament.

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.

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. Pay close attention to the Good and Excellent categories in order to understand the desired result. These guidelines will be the same ones used by the judges during each event and *FIRST* Vex Challenge event that will be held at the *FIRST* Championship.

It is important to remember that this is the team's opportunity to highlight how they rallied as a team around the robot, the technical information that was learned 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 mentor is what the judges will be looking for during the team interview.

Chapter 8 - Team Resources

8.1 OVERVIEW

This chapter provides teams with necessary information for contacting *FIRST* Vex™ Challenge staff, accessing technical support, and using the *FIRST* and *FIRST* Vex Challenge logos.

8.2 FIRST CONTACT INFORMATION

You can reach the *FIRST* Vex staff by phone at (800) 871-8326 or e-mail at firstrv@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. Refer to the information below for the appropriate help resource.

8.3 GETTING ANSWERS TO YOUR QUESTIONS

Use the following guidelines when submitting your questions to *FIRST* Vex staff:

1. Only team leaders can e-mail questions.
2. Please submit one question at a time.
3. Teams will need to incorporate the following information when submitting a question:
   - In e-mail Subject line: The text “Q&A”
   - In e-mail Body: Rule and page number in question
   - Team number

For general information and questions regarding the *FIRST* Vex Challenge pilot, send an e-mail request to firstrv@usfirst.org.

For questions regarding the *FIRST* Vex Challenge *Half-Pipe Hustle* game, visit www.usfirst.org/vex/index.html for information on how to access the Game Q&A forum.

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

Website	Description
www.usfirst.org/vex/index.html	*FIRST* Vex Challenge pilot information, registration, FAQs, and team resources
www.radioshack.com	Radio Shack, sponsor of the *FIRST* Vex Challenge
www.vexrobotics.com	Vex Robotics Design System parts and accessories
www.vexlabs.com	Vex parts/accessories, forum, and technical support
www.intelitek.com	Vex programming software upgrades and technical support

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. Through the *FIRST* Vex Challenge, not every team will have direct access to an engineer for support, so *FIRST* will be offering a Virtual Engineer. These Virtual Engineers will be available on the web through a forum for those students without engineering support for their team or students in need of some guidance through the design or programming process.

To submit a question to a *FIRST* Vex Challenge Virtual Engineer, visit http://www.vexlabs.com/forum/.

8.5 TEAM DEVELOPMENT SUPPORT

In addition to the staff at *FIRST* headquarters, an additional regional level of support is available through the *FIRST* Regional Directors and *FIRST* Senior Mentors. Regional Directors assist with team-related needs such as finding a team sponsor. To find out the name of the Regional Director in your area, send an e-mail request to firstrv@usfirst.org. *FIRST* Senior Mentors, a corps of experienced *FIRST* volunteers, assist teams with team development, team mentor guidance and other needs. Send an email to firstrv@usfirst.org to inquire if a Senior Mentor is available in your area.

8.6 USING THE FIRST AND FVC 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. 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 FVC logos and Logo Standards information from the *FIRST* Vex Challenge web site at www.usfirst.org/vex/index.html. Keep in mind the following when working with the *FIRST* and FVC logos:

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

Unmodified: Use the *FIRST* and FVC 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 FVC logos, do that only when you receive our permission. *FIRST* is happy to talk with you about modifications after you 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, 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.