VEX ROBOTICS COMPETITION

elevation

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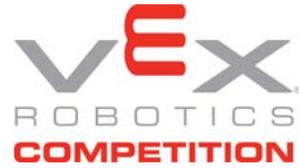
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Introduction

Overview

This section provides an introduction to *Elevation* and the VEX Robotics Competition.

Origins of the VEX Robotics Competition

Given today's global challenges compared to the rest of recoded history, there has never been an age with a greater need for new scientists, engineers and problem solving leaders. Recent breakthroughs in chemistry, medicine, materials and physics have revealed a new set of challenges and created even greater opportunity for problem solving through technology. This underscores a dramatic challenge: there are not enough high school graduates choosing technology related majors in college. This does not reflect a lack of capacity for new students on the part of technical schools and universities, but a lack of interested and qualified applicants. In short, we will not be able to meet the demand for problem solvers in the next generation unless the shortage is directly addressed.

Recognizing this dilemma, scores of organizations are creating programs designed to attract and engage young students in the study of science and technology. Many have found that robotics is a very powerful platform to attract and hold the attention of today's multi-tasking, connected youths. Robotics has strong appeal to this intensely competitive generation and represents the perfect storm of applied physics, mathematics, computer programming, digital prototyping and design, integrated problem solving, teamwork and thought leadership. Students with a previously undiscovered aptitude for STEM (Science, Technology, Engineering, and Math) curriculum are flourishing in growing numbers due to the efforts of schools, volunteer organizations, corporations, and governments internationally.

Designed by Innovation First, Inc., a leader in educational and competitive robotics products, the VEX Robotics Competition is the next generation of educational robotics competitions. While there are many existing quality robotics competitions worldwide, the VEX Robotics user community has overwhelmingly demanded new challenges that are easy and economical to host and implement. It is IFI's strong desire to serve the needs of all VEX Robotics users in order to attract, nurture and grow new engineering candidates worldwide who will solve the problems of tomorrow.

IFI's VEX Robotics Design System is a leading classroom robotics platform designed to nurture creative advancement in robotics and knowledge of STEM education. VEX provides teachers and students with an affordable, robust, and state-of-the-art robotics system suitable for classroom use and the playing field. VEX's innovative use of pre-manufactured and easily formed structural metal, combined with a powerful and user-programmable microprocessor for control, leads to infinite design possibilities.

More Ways To Play The Game

In addition to the VEX Robotics Competition tournament, which focuses on an exciting alliance structure having teams working as partners to play matches against an alliance of opponents, we have added two new challenges to the 2008-2009 season: the Robot Skills Challenge and the Programming Skills Challenge. While the alliance structure teaches teams the value of co-operation and communication in head-to-head play, teams now can also demonstrate individual robot and autonomous programming skills and abilities at events that offer these opportunities.

Elevation – A Primer

Elevation is an exciting and dynamic game which will provide teams with a high paced challenge for the duration of each two minute and twenty second match. Each tournament match consists of two distinct types of play – operator-controlled and autonomous. Matches feature alliances of two teams playing from opposite sides of the playing field. Teams will compete to score the most points by completing various tasks including, lifting cubes and placing them in goals, manipulating a giant bonus cube and navigating themselves onto the ramp-like platform.

While participating in the *Elevation* season, teams will develop many new skills in response to the challenges and obstacles which stand before them. Some problems will be solved by individuals, whiles others will be handled through interaction with their student teammates and adult mentors. Teams will work together to build a VEX robot to compete in one of many tournaments, where they celebrate their accomplishments with other teams, family and friends. After the season, students come away not only with the accomplishment of building their own competition robot, but with an 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, and leadership as well as research and technical skills.
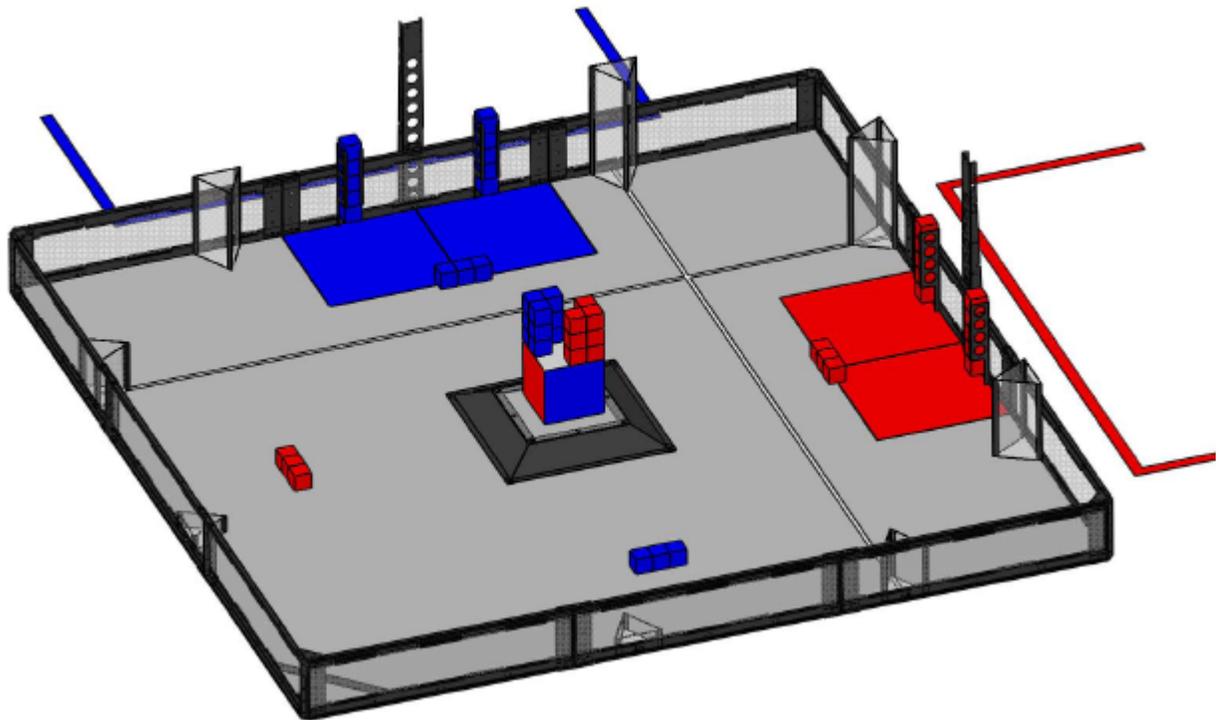
The Game

Overview

This section describes the VEX Robotics Competition game, called *Elevation*. It also lists the game definitions and game rules.

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 opponent *alliance* by placing your colored *cubes* into *goals*, *owning goals*, *controlling* the *bonus cube* and by being *parked* on the *platform*.

A bonus is awarded to the *alliance* that has the most total points at the end of the *Autonomous Period*.

There are a total of 58 *cubes*, 29 for each *alliance*, available as scoring objects in the game. Thirty of these *cubes* will be found on the field, 20 in *auto-loaders,* while four will be available to each *alliance* prior to the *match*. There is a larger multi colored *bonus cube* on the *platform* at the start of the match.

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 in appendix A for exact field dimensions, a full field BOM and exact details of field construction. Lower cost field options are also provided in appendix B.

VEX Robotics Competition - *Elevation*
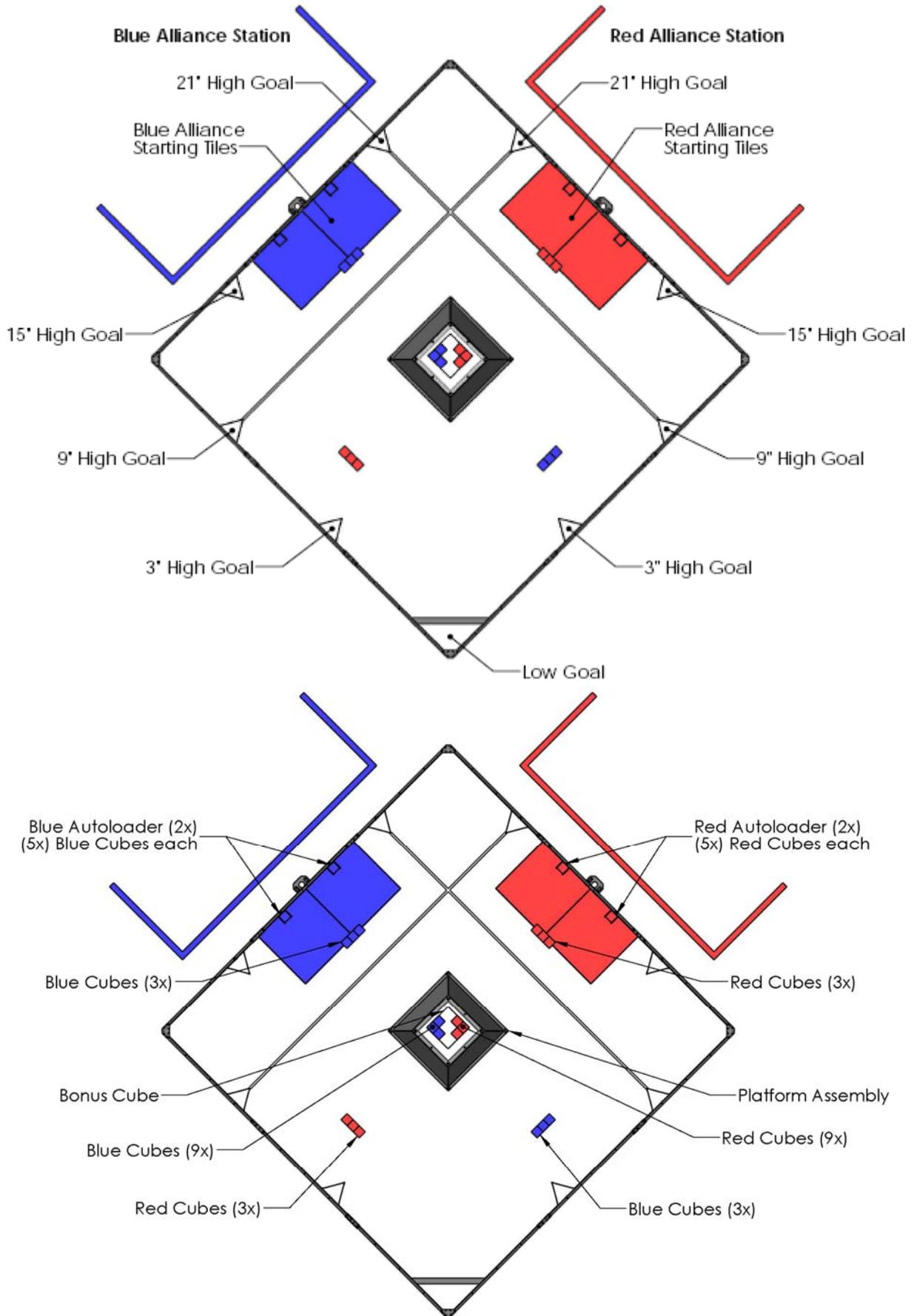
Game Definitions

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*.

Alliance Tiles – The two colored tiles for each alliance located at the center of the wall adjacent to the corresponding *alliance station*.

Auto-Loader – One of four *cube* dispensers located on the walls adjacent to the *alliance stations*.

Autonomous Period – A 20-second time 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.

Bonus Cube – A multi-colored 10.5" cube, located on the *platform* at the start of a *match.* The *bonus cube* is colored such that opposite faces are the same color. The *bonus cube* weighs approximately 0.94 pounds.

Coach -- A student or adult mentor designated as the team advisor during the match. Only one (1) of these is allowed per team on the field at any given time.

Controlled -- A *bonus cube* is considered to be *controlled* by an *alliance* if their colored (red or blue) face of the *bonus cube* is completely touching the foam playing surface.

Cube – A 3" red or blue cubic scoring object. Each *cube* weighs 0.028 pounds.

Driver - A student team member responsible for operating and controlling the *Robot*. Only two (2) of these are allowed per team on the field at any given time.

Driver Controlled Period – The 2:00 (two minute) time period in which the *robots* are operated by the *drivers.*

High Goal – One of the eight triangular shaped field structures of varying height into which teams can *score cubes.*

Low Goal – A triangular region of the field, marked by a tape line, where teams can *score* cubes.

Match - A *match* consists of an *autonomous period* followed by a *driver controlled period* for a total time of 2:20 (two minutes, twenty seconds).

Owned – A *High Goal* is considered to be *owned* by an *alliance* if their colored *cube* is the vertically highest *cube scored* within the goal.

Parked – A robot is considered to be *parked* when it is in contact with the platform, and no part of the *robot* is in contact with the foam playing surface.

Platform – The central steel ramp and lexan horizontal surface at the centre of the field.

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

Scored – A *cube* is *scored* in a high *goal* if some part of the *cube* is within the triangular space defined by the outer edges of the *goal*, and not touching a *robot* of the same *alliance*. A *cube* is *scored* in a low *goal* if any part of the *cube* is within the triangular space defined by outer edges of the tape which defines 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.

Game Rules

Scoring

- A *cube* that is *scored* in a *goal* is worth one (1) point for the *alliance* of the color of the *cube.*
- A *high goal* that is *owned* is worth five (5) points for the *owning alliance.*
- A *bonus cube* that is *controlled* is worth five (5) points for the *controlling alliance*.
- A *robot* that is *parked* at the end of the *match* is worth five (5) points for the corresponding *alliance*.

Scoring in Autonomous Mode

- At the end of the *autonomous period,* the *alliance* that has more total points excluding the *bonus cube* receives a five (5) point bonus.

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

General Game Rules

<G1> At the beginning of a *match*, each *robot* must not exceed a volume of 18 inches wide by 18 inches long by 18 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 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*.

<G4> *Cubes* and *bonus cubes* that leave the playing field are considered out of play. These objects will NOT be returned to the field.

<G5> *Drivers* and *coaches* are prohibited from making intentional contact with any game or field object or robots during a *match*. Any intentional contact will result in a disqualification. Accidental contact will not be penalized, unless the contact directly impacts the final score of the match. This type of accidental contact will result 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* either immediately after the *match* or when all objects on the field 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 prevents scoring the team will be disqualified. Multiple intentional infractions may result in disqualification for the entire competition.

<G9> Strategies aimed solely at the destruction, damage, tipping over, or entanglement of *robots* are not in the spirit of the VEX Competition and are not allowed. However, *Elevation* 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 *cubes* from any grasping mechanism without requiring that the *robot* have power after the *match*.

<G11> Field tolerances may vary by as much as +/-1", so teams must design their *robots* accordingly.

<G12> Cube tolerances may vary by as much as +/-1/8", so teams must design their *robots* accordingly.

<G13> All teams must adhere to all VEX Robotics Competition Rules as they are written, and must abide by the spirit of the rules. Every team has the opportunity to ask for official rules interpretations in the VEX Robotics Competition Question & Answer Forum. Any responses in this Q&A forum should be treated as official rulings from the VEX Robotics Competition Game Design Committee, and represent the correct and official interpretation of the VEX Robotics Competition Rules.

The VEX Robotics Competition Question & Answer Forum can be found at www.RobotEvents.com and www.VEXforum.com

Elevation Specific Game Rules

<SG1> At the beginning of each *match*, each *alliance robot* must be placed such that they are touching one of the colored *alliance tiles* and not touching any *cube* other than those permitted by **<SG2>**.

<SG2> Prior to the start of each *match*, each team will have two (2) *cubes* available to preload into their robots.
   a.   A *cube* is considered to be legally preloaded if it is touching the *robot* and not touching any part of the playing field or game objects.

<SG3> A *cube* is not considered *scored* if it is being touched by a *robot* on an *alliance* of the same color at the conclusion of either period.

<SG4> A *robot* cannot pin (inhibit the movement of an opposing *robot* while in contact with one or more field elements, excluding the *platform*) an opposing *robot* for more than five seconds while on the foam playing surface. If a referee determines this rule to be violated, the offending *robot* will be disqualified for the match.

Note: In order to be pinned, a *robot* must be in contact with one or more field elements, excluding the *platform*; a robot may block or inhibit the movement of an opposing robot as long as no contact with field elements is involved.

<SG5> *Elevation* is a highly interactive game. Contact, ramming and tipping is especially likely to occur on the *platform* as part of normal gameplay. Robots should be designed accordingly as these interactions on the *platform* would not fall under <G9>.

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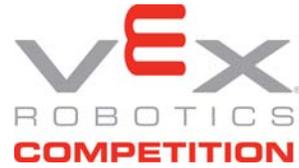
The Tournament

Overview

The main challenge of the VEX Robotics Competition 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 tournament champions.

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.*

Crystal Assignment – The designated radio frequency crystal that a team will use for a given match. These crystals will be provided to teams before each match.

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

Practice Match – An un-scored 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.*

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 are not scored, and will not affect team ranking.
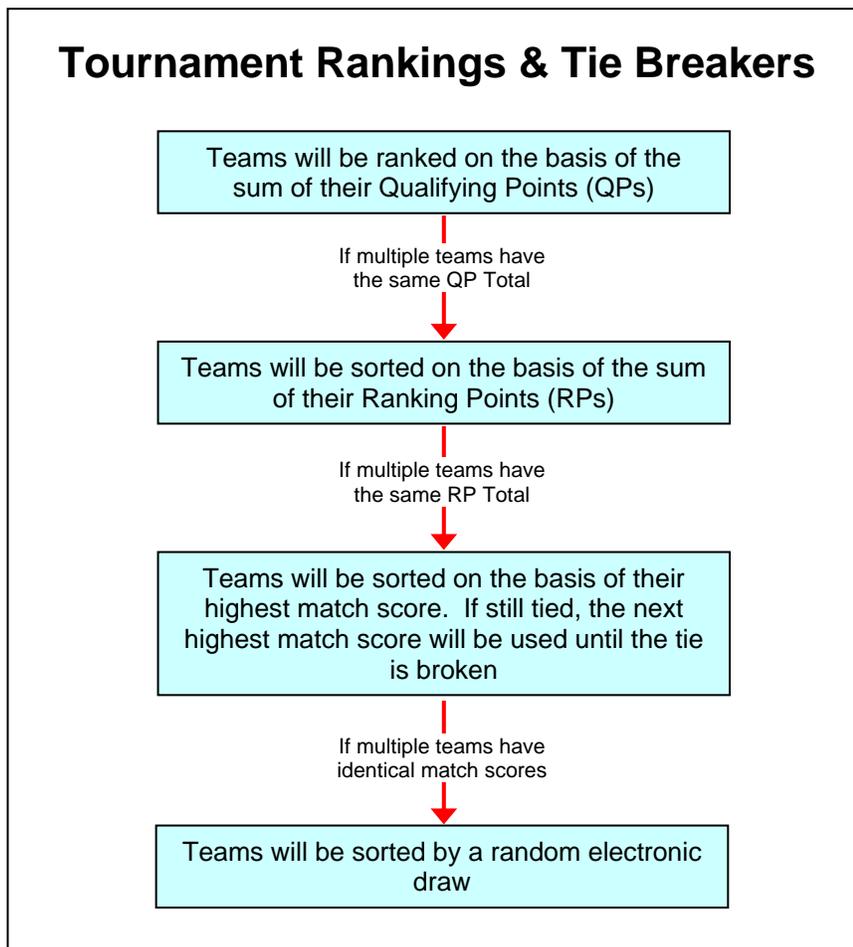
Qualifying Matches

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 within the alliance station, as well as your *crystal assignment*.
- 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.

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.
- 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*.

Tournament Rankings & Tie Breakers

Teams will be ranked on the basis of the sum of their Qualifying Points (QPs)

If multiple teams have the same QP Total

Teams will be sorted on the basis of the sum of their Ranking Points (RPs)

If multiple teams have the same RP Total

Teams will be sorted on the basis of their highest match score. If still tied, the next highest match score will be used until the tie is broken

If multiple teams have identical match scores

Teams will be sorted by a random electronic draw

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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.

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 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.
- Prior to each *elimination match*, the *alliance captain* must let the referee know which two teams will playing in the upcoming match

Match Ladder

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

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.
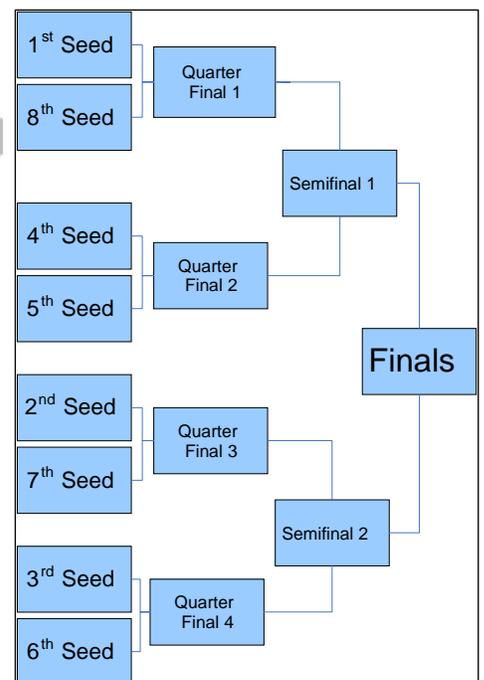
Tournament Rules

<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.

<T02> The only people permitted by 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> All team members, including coaches, <u>must</u> wear safety glasses or glasses with side shields while in the pit or alliance stations during matches.

<T05> Once a robot has been placed & oriented on the field, team members are NOT allowed to adjust its position.
a. During Qualification matches, the BLUE alliance must place & orient their robots on the field first.
b. During Elimination matches, the LOWER-seeded alliance must place & orient their robots on the field first. *(i.e. in a match between the 4th Seeded Alliance and the 5th Seeded Alliance: the 5th Seeded Alliance is the lower seed and must place their robots first, once placed & oriented they cannot readjust their robots.)*
c. If the alliance that placed their robots on the field first makes an illegal adjustment to their robots, the alliance that placed their robots on the field last will always have the last opportunity to orient/adjust their robot placement. Multiple illegal adjustments can result in a DQ at the discretion of the head-referee.

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 between 17 and 23 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 → 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 8th alliance, thereby awarding a bye to the 1st alliance in the quarter-finals.)
- If there are 16 or less 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 → 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 8th alliance, thereby awarding a bye to the 1st alliance in the quarter-finals.)

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The Robot

Overview

This section provides rules and requirements for the design and construction of your robot. A VEX Robotics Competition robot is a remotely operated and/or autonomous vehicle designed and built by a registered VEX Robotics Competition student team to perform specific tasks when competing in *Elevation*. Prior to competing at each event, all robots will have to pass an inspection. Refer to Appendix C for the Robot Inspection Guidelines and the Inspection Checklist.

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 (1) PRIMARY robot will be allowed to compete per team in the VEX Robotics Competition. Though it is expected that teams will make changes to this robot at the competition, a team is limited to ONE (1) PRIMARY robot. Restrictions for this are as follows:
  a. Teams may build an additional SECONDARY robot for use ONLY in the Programming Skills Challenge (refer to Section 5 for more information on the Programming Skills Challenge). This additional robot is optional; teams may use their PRIMARY robot to compete in the Programming Skills Challenge if they want. Any SECONDARY robot is subject to the same robot rules
  b. It is against the intent of this rule to compete with one PRIMARY robot, while a second is being modified or assembled.
  c. It is against the intent of this rule to switch back and forth between multiple PRIMARY 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 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 Appendix C, 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.

<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, etc) MUST remain attached to the robot for the duration of the match.

<R5> Robot construction is constrained to the following:

a. All Official VEX Robotics Design System *Robot* Components may be used (except as limited below).
Please note that any new Official VEX Robotics Design System *Robot* Components that are not currently available, but released during the season will be considered legal.
Consult www.VEXrobotics.com for the most up to date list of legal components.

- Only the VEX Robotics Design System Components specifically designed to be used for Robot construction are allowed. Using additional components outside their typical purpose is against the intent of the rule (i.e. please don't try using VEX apparel, competition support, or other non-robot products on a VEX Robotics Competition Robot).
- Only one (1) VEX Microcontroller
- Up to two (2) VEX RF Receiver Modules
- Up to ten (10) VEX Motors or VEX Servos (Any combination, up to ten)
- Up to one (1) VEX Power Expander (276-2271)
  - The VEX Power Expander is a new product expected to ship during mid-season
- The only allowable source of power for a VEX Robotics Competition Robot is a single (1) VEX 7.2V Robot Battery Pack, unless the robot is utilizing the VEX Power Expander. Robots utilizing the VEX Power Expander can use a second (2) VEX 7.2V Robot Battery.
  - Additional batteries cannot be used on the robot (even ones that are not connected).
  - New VEX products requiring power may be added during the course of the season and will be governed on a case by case basis.
- VEX Y-Cables are allowed, however a maximum of (1) Y-Cable can be used per Motor Port of the Microcontroller or Power Expander.
- Electrical components & motors from the VEX-RCR product line are prohibited.
  - This includes electronics from the VEX-MiNi & VEXplorer systems.
- The packaging, manual binders, styrofoam, cardboard, plastic bags, software CD's etc. from the VEX kits are NOT included and CANNOT be used for robot construction. Only the VEX robot parts themselves are allowed.

Note: Official VEX products are ONLY available from VEX & Official VEX Resellers.
To determine whether a product is "official' or not, consult www.VEXrobotics.com.
Products identical to those listed on this site are also considered "official VEX products".

b. The following additional components may also be used:
- 48" of 1/8" Nylon Rope
- Any material strictly used as a color filter for a VEX Light Sensor
c. Any parts which are identical to legal VEX parts may be used.
d. Teams may add non-functional decorations from parts not on the above list, provided that these parts do not affect the outcome of the match, and must be in the spirit of the competition.
e. No additional components may be used.

<R6> All parts that are used must be tracked through a Bill of Materials (BOM).

<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. Such types of documentation include receipts, part numbers, or other printed documentation.

<R8> No more than two VEX transmitters may control a single robot during the tournament. No modification of these transmitters 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 within the VEX Robotics Design System will NOT be allowed.

- Mechanical fasteners may be secured using Loctite or a similar thread-locking product.
  - This may be used for securing hardware ONLY.

<R10> Robot receiver must be accessible by competition personnel.
   a. The radio crystal must be easily removed from the robot without any robot disassembly.
   b. The radio crystals will be provided to each team for each match.

<R11> To participate in an official VEX Robotics Competition Tournament a team must first register on www.RobotEvents.com. Upon registering they will receive their VEX Team Identification Number (VEX Team ID#) and a welcome kit containing VEX Team Identification Number Plates. Every robot should have their VEX Team ID# Plates displayed on a minimum of 2-opposing sides.

<R12> Robots must include a mounting device to securely hold one VEX Robot Identification Flag throughout an entire match.
   a. The flags will be issued to teams in their VEX Robotics Competition registration materials.
   b. These flags may also be available at some events
   c. Replacement and extra flags are available for purchase at www.VEXrobotics.com
   d. For flag details please refer to the following diagram.
   e. VEX Threaded Standoffs work as simple flag holders, as shown below.
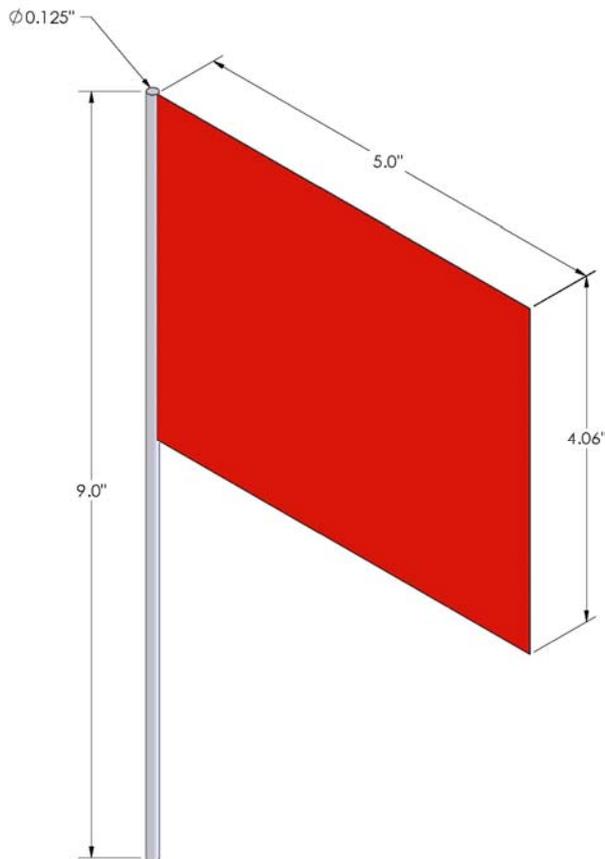
<R13> Robots must utilize the correct Competition Software Templates, and the most updated version of Microcontroller Master Code as specified by the VEX Robotics Competition Programming Guide.
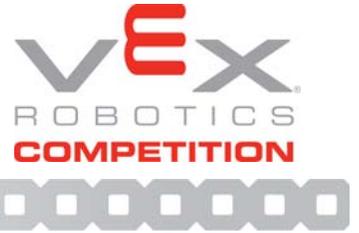
Autonomous Programming Guidelines

Teams participating in the VEX Robotics Competition must adhere to certain programming guidelines. Please refer to the Programming Guide in Appendix D for requirements concerning programming a VEX Robotics Competition robot.

5 The Programming Skills Challenge

SECTION

Overview

This section describes the Programming Skills Challenge of *Elevation*.

Please note that the Programming Skills Challenge may not be offered at all tournaments. Please check with your local event organizer, or www.robotevents.com for more information.

Programming Skills Challenge Description

In this challenge teams will compete in 1:00 long autonomous only matches in an effort to score as many points as possible. The playing field will be set up identically to that of a normal *Elevation* tournament match, with the following exceptions.

- There are no *cubes* on top of the *bonus cube* to start the match.
- Only one robot is on the field with only one team competing at a time

(Please see "The Game" section of the manual for further information on field setup)

Programming Skills Challenge Definitions

Please note that all definitions from "The Game" section of the manual apply to the Programming Skills Challenge, unless otherwise specified.

Programming Skills Challenge (PSC) Controlled -- A *bonus cube* is considered to be *PSC controlled* by a team if the *bonus cube* is not touching the *platform*. The face/color of the cube in contact with the surface has no impact on *PSC control*.

Programming Skills Match – A *Programming Skills Match* consists of a 1:00 *autonomous period*. There is no *driver controlled period*.

Programming Skills Challenge Rules

Please note that all rules from "The Game" section of the manual apply to the Programming Skills Challenge, unless otherwise specified.

Programming Skills Challenge Scoring

- A *cube* that is *scored* in a *goal* is worth one (1) point for the *scoring* team.
- A *high goal* that is *owned* is worth five (5) points for the *owning* team*.
- A *robot* that is *parked* at the end of the *match* is worth five (5) points for the *parking* team.
- A *bonus cube* that is *PSC controlled* is worth five (5) points for the *PSC controlling* team

General Programming Skills Challenge Rules

<GPSC1> For all *programming skills matches*, teams are considered to be both blue and red. Hence, teams are eligible to earn points for *scoring* both colored cubes.

Elevation Specific Programming Skills Challenge Rules

<SPSC1> Prior to the start of each *programming skills match*, each team will have four (4) *cubes* available to preload into their robots.
   a. A *cube* is considered to be legally preloaded if it is touching the *robot* and not touching any part of the playing field or game objects.

Programming Skills Challenge Format

- The Programming Skills Challenge is an optional event. Teams who do not compete will not be penalized in either the main tournament, or the Robot Skills Challenge.
- Teams will play *programming skills matches* on a "first come, first serve" basis.
- Teams will be guaranteed a minimum number of *programming skills matches*, to be determined by the local event organizers
- Teams will also be limited to a maximum number of *programming skills matches*, to be determined by the local event organizers

Programming Skills Challenge Rankings

- For each *programming skills match* teams are awarded a score based on the above scoring rules.
- Teams will be ranked based on their highest *programming skills match* score, with the team with the highest score being declared the Programming Skills Challenge Winner.
- In the case where two teams are tied for the highest score, the tie will be broken by looking at both teams next highest *programming skills match* score.
- If the tie cannot be broken (i.e. both teams have the exact same scores for each *programming skills match*), both teams will be declared the winner.

Programming Skills Challenge Heads-Up Match

The following method will be used to determine the Programming Skills Challenge Winner at certain events, including the 2009 World Championship of VEX Robotics.
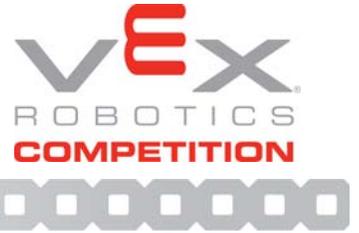
- The top two teams from the Programming Skills Challenge Rankings will advance to a final heads-up match.
- Each team will perform one (1) *programming skills match*, with the 2nd place team performing first.
- The team with the highest score in this heads-up match, will be declared the Programming Skills Challenge Winner.

6

The Robot
Skills Challenge
Overview

This section describes the Robot Skills Challenge of *Elevation*.

Please note that the Robot Skills Challenge may not be offered at all tournaments. Please check with your local event organizer, or www.robotevents.com for more information.

Robot Skills Challenge Description

In this challenge teams will compete in 1:00 long driver controlled only matches in an effort to score as many points as possible. The playing field will be set up identically to that of a normal *Elevation* tournament match, with the following exception.

- There are no *cubes* on top of the *bonus cube* to start the match.
- Only one robot is on the field with only one team competing at a time

(Please see "The Game" section of the manual for further information on field setup)

Robot Skills Challenge Definitions

Please note that all definitions from "The Game" section of the manual apply to the Programming Skills Challenge, unless otherwise specified.

Robot Skills Match – A *Robot Skills Match* consists of a 1:00 *driver controlled period*. There is no *autonomous period*.

Robot Skills Challenge Rules

Please note that all rules from "The Game" section of the manual apply to the Robot Skills Challenge, unless otherwise specified.

Robot Skills Challenge Scoring

- A *cube* that is *scored* in a *goal* is worth one (1) point for the *scoring* team.
- A *high goal* that is *owned* is worth five (5) points for the *owning* team.
- A *bonus cube* that is *controlled* is worth five (5) points for the *controlling* team.
- A *robot* that is *parked* at the end of the *match* is worth five (5) points for the *parking* team.

Elevation Specific Robot Skills Challenge Rules

<SRSC1> Prior to the start of each *robot skills match*, each team will have four (4) *cubes* available to preload into their robots.
   a. A *cube* is considered to be legally preloaded if it is touching the *robot* and not touching any part of the playing field or game objects.

Robot Skills Challenge Format ▢▢▢▢▢▢▢▢▢▢▢▢▢▢

- The Robot Skills Challenge is an optional event. Teams who do not compete will not be penalized in either the main tournament, or the Autonomous Challenge.
- Teams will play *robot skills matches* on a "first come, first serve" basis.
- Teams will be guaranteed a minimum number of *robot skills matches*, to be determined by the local event organizers
- Teams will also be limited to a maximum number of *robot skills matches*, to be determined by the local event organizers

Robot Skills Challenge Rankings ▢▢▢▢▢▢▢▢▢▢▢▢▢

- For each *robot skills match* teams are awarded a score based on the above scoring rules.
- Teams will be ranked based on their highest *robot skills match* score, with the team with the highest score being declared the Robot Skills Challenge Winner.
- In the case where two teams are tied for the highest score, the tie will be broken by looking at both teams next highest *robot skills match* score.
- If the tie cannot be broken (i.e. both teams have the exact same scores for each *robot skills match*), both teams will be declared the winner.

Robot Skills Challenge Heads-Up Match ▢▢▢▢▢▢▢▢▢▢

The following method will be used to determine the Robot Skills Challenge Winner at certain events, including the 2009 World Championship of VEX Robotics.

- The top two teams from the Robot Skills Challenge Rankings will advance to a final heads-up match.
- Each team will perform one (1) *robot skills match*, with the 2nd place team performing first.
- The team with the highest score in this heads-up match will be declared the Robot Skills Challenge Winner.