

ROBOTICS EDUCATION & COMPETITION FOUNDATION

RECF VIQC, VRC, and VEX U Team Guide

2021-2022

For Coaches, Team Members, Teachers, and Parents

Table of Contents

How to Use this Guide	4
Before You Begin, Which Program to Pick?	5
VEX IQ Challenge (Elementary/Middle School):	5
VEX Robotics Competition (Middle/High School):	5
VEX U (Post-Secondary):	5
Robotics Season – Start to Finish	6
Stage 1. Team Registration	6
Option 1 – New School/Organization	6
Option 2 – Returning Team at a Returning School/Organization	8
Option 3 – New Team at a Returning School/Organization.....	8
Stage 2. Forms, Policies and Procedures	10
Participant Release Form	10
Student-Centered Policy.....	10
Code of Conduct.....	10
Stage 3. Before the Build: Starting A Team	11
Develop Your Team	11
Equipment for Your Team.....	11
Assemble a Tool Kit.....	12
Fundraising	12
Registering Your Team for Competition Season.....	13
Plan Your Schedule	13
Plan Your Team Meetings	13
Assign Team Roles.....	13
Develop a Team Identity.....	14
Stage 4. Build Time!: Engineering Design Process	14
Step 1: Engineering Design and Documentation	14
Step 2: Research and Brainstorm the Game	16
Step 3: Prototype and Design the Robot.....	17
Step 4: Test, Troubleshoot and Iterate.....	18
Step 5: Get Ready to Compete!	19
Stage 5. Attending an Event	23
Safety Procedures at Events	23
What to Expect at an Event	24
Key Terms.....	24

Bonus: Additional REC Foundation Information 28

REC Foundation Inclusion Initiatives..... 28

REC Foundation Sponsors 28

REC Foundation Grants 28

Online Challenges: Get Everyone Involved..... 28

Acronym Guide 29

Social Media..... 29

Note: Should anything in this Team Guide contradict the Game Manuals or Qualifying Criteria Documents, those documents will take precedence. All of these official documents are explained further in this Guide.

How to Use this Guide

Coach's Corner: Congratulations, and "Thank You!" for coaching a team of students interested in STEM. As the world grows increasingly complex the need for individuals equipped with the knowledge and skills to tackle tough problems by gathering information, evaluating it, and presenting effective solutions continues to increase. Still, relatively few students are proficient in the core subjects of science, technology, engineering, and mathematics (STEM) and even fewer express interest in pursuing these fields beyond high school. Increasingly, educators and students alike seek hands-on, sustainable, and cost-effective approaches to help engage young people and maintain their interest in STEM through elementary school, middle school, high school, and beyond. Your willingness to coach a robotics team is the next step in solving the STEM problem!

The intention of this Team Guide is to prepare you and team members for the robotics competition season, the Engineering Design Process and your first event. Good luck this year and may you and your team have a great season!

- The Robotics Education & Competition (REC) Foundation is a non-profit that hosts world-wide robotics competitions. The REC Foundation's mission is to increase student interest and involvement in STEM by engaging students in hands-on, affordable, and sustainable robotics engineering programs.
- REC Foundation robotics teams are associated with public schools, private schools, after school groups, home school groups, scouting groups, 4H groups, etc.
- REC Foundation team coaches are not required to have a background in STEM education. Coaches with all types of backgrounds are successful in a robotics program. The Coaches role is to guide your students in this exciting adventure.
- A Mentor is a person associated with your team that volunteers time, knowledge, energy and/or effort to help along the team's season.
- Your Team Engagement Manager (TEM) and Event Engagement Manager (EEM) are dedicated REC Foundation employees that work to bring a successful season to every Team, Coach and Mentor in their Region.

Note: Non-USA based teams are not going to have a separate Team Engagement Manager (TEM) and Event Engagement Manager (EEM). Instead, these teams are supporting by one Regional Support Manager (RSM). Your RSM fulfills all references to TEM and EEM in this Team Guide.

- Find your TEM, EEM, or RSM:
➔ <https://www.robotevents.com/support>

Before You Begin, Which Program to Pick?

VEX IQ Challenge (Elementary/Middle School):

➔ <https://www.roboticseducation.org/vex-iq-challenge/>

A plastic based robotics platform with snap-together pieces. The matches occur on a 6'x8' rectangular field. Two (2) robots compete in the Teamwork Challenge as an alliance in 60-second-long teamwork matches, working collaboratively to score points. Teams also compete in the Robot Skills Challenge where one robot takes the field to score as many points as possible. These matches consist of Driving Skills Matches, which are entirely driver controlled, and Programming Skills Matches, which are autonomous with limited human interaction.

VEX Robotics Competition (Middle/High School):

➔ <https://www.roboticseducation.org/vex-robotics-competition/>

A metal-based robotics platform with bolt-together pieces that are machinable to create any mechanism. The matches occur on a 12'x12' square field. Two (2) Alliances, composed of two (2) Teams each, compete in matches consisting of an Autonomous Period followed by a Driver Controlled Period. The object of the game is to attain a higher score than the opposing Alliance. Teams also compete in the Robot Skills Challenge where one robot takes the field to score as many points as possible. These matches consist of Driving Skills Matches, which are entirely driver controlled, and Programming Skills Matches, which are autonomous with no human interaction.

VEX U (Post-Secondary):

➔ <https://www.roboticseducation.org/vex-u/>

Same as VRC above except the VEX U teams bring two (2) robots to the field, thus creating their own alliance. VEX U Teams are also allowed to use non-VEX parts, opening up to limitless design possibilities.

*** Important Note:** The yearly Game Manuals define the age ranges for each student classification: Elementary School, Middle School, High School and Post-Secondary.

Three Competitions in One Event

Fun Fact: When your teams attend an event they are not competing in just Game Matches, but there are usually two other competitions as well. That is three (3) competitions in one (1) event! Read "[Stage 5: Attending an Event](#)" for more details.

3 COMPETITIONS IN ONE EVENT

**Driver's Skills Challenge
Matches**
Are entirely driver
controlled, building problem
solving, critical thinking and
teamwork skills.



Game Challenge Matches
Multiple robots compete with
other robots to score as many
points as possible.

**Programming Skills
Challenge**
One robot takes the field to
score as many points as
possible during an
autonomous round with
limited human interaction.

Robotics Season – Start to Finish

Coach’s Corner: Coaching a robotics team is a truly rewarding experience. It may, at first, appear daunting, but the Robotics Education & Competition (REC) Foundation provides tools and resources to give you everything you need for success. This Guide steps you through a season from start (registering a team in RobotEvents.com) to finish (team debrief and celebration).

Your Team Engagement Manager (TEM) is your best friend as you experience robotics. Reach out directly to him/her if you have any questions throughout this Team Guide. Also, ask your TEM to connect you with a local coach and/or local/regional social media groups that can act as a mentor in your first years. Look for Team Blast emails from your TEM and the REC Foundation. Additionally, follow REC Foundation and VEX Social Media for the latest announcements.

To find your TEM, go to <https://www.robotevents.com/support> and click on your state. Note the contact information once it is visible on the screen for questions about any REC Foundation programs.

Stage 1. Team Registration

Most team registrations will fit into one of three categories:

- [Option 1 - New School/Organization](#)
- [Option 2 - Returning Team at a Returning School/Organization](#)
- [Option 3 - New Team at a Returning School/Organization](#)

The steps below for each of these registration types is an abbreviated version for those familiar with the process. The REC Foundation, however, has a stand-alone document with more details, screenshots, Frequently Asked Questions, and steps on how to pay with a Purchase Order (PO). This document is found here:

➔ <https://www.roboticseducation.org/teamregistration>

Option 1 – New School/Organization

Step 1: Browse to <https://www.robotevents.com>.

Step 2: (New School) You will first need to create a "Login".

- Click on “Register.” Enter all required information and click the “Register” button.
- Enter your email and password and click "Login".

Step 3: Check to ensure that the correct year is listed in the “Season” dropdown menu on the right-hand side. Click the "Register a Team" button.

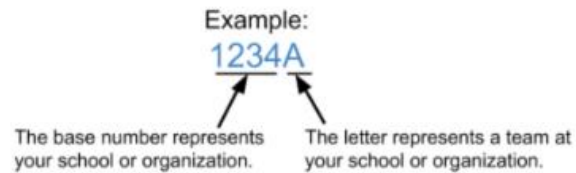
Step 4: Select the circle next to the program in which you wish to register, either “VIQC Team Registration,” “VRC Team Registration,” or “VEX U Team Registration.” Then click the “Next” button.

Note: You will have to repeat this step if you are registering multiple teams

Step 5: Enter the details of your school/program in the organization information panel. Click the “Next” button.

Step 6: In the team information panel, either enter in the team number that you would like or allow the system to generate the number for you by clicking the ↻ symbol. If you request a team number that is already in use, you will be notified that it is unavailable.

Please note the following regarding how team numbers work:



As such, all teams in a single program (VIQC, VRC or VEX U) from a school or organization should have the same base number.

Step 7: Enter in the details of the demographics of your team as well as your sponsor’s name and emergency contact info. Then click the “Next” button.

Step 8: Enter in team contact information. Then click the “Next” button.

Step 9: Enter details of your team, including team and robot name, in the team profile panel. Add social media information if applicable.

Note: You can change this later or year-to-year.

Step 10: Click “Finish” to complete the registration process for this team. Your team’s registration will now be added to your cart for checkout. Please note that your team’s registration is not complete until it is paid for.

Option 2 – Returning Team at a Returning School/Organization

- Step 1:** Browse to <https://www.robotevents.com>.
- Step 2:** (Returning School) If you already have an account click "Login".
- Enter your email and password and click "Login".
- Step 3:** Click the "Renew Teams" button on the right-hand side.
- Step 4:** Click "Renew" for any of the team numbers from previous seasons which you wish to renew for the current season.
- Step 5:** Update any details of your school/program in the organization information panel. Click the "Next" button.
- Step 6:** Your Team Number is already selected in the team information panel. Verify or adjust details of the demographics of your team as well as your sponsor's name and emergency contact info. Click the "Next" button.
- Step 7:** Verify or update contact information in the contacts panel. Click the "Next" button.
- Step 8:** Verify or update details of your team, including team and robot name, in the team profile panel. Add social media information if applicable.

Note: You can change this later or year-to-year.

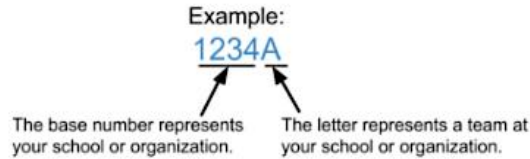
- Step 9:** Click "Finish" to complete the registration process for this team. Your team's registration will now be added to your cart for checkout. Please note that your team's registration is not complete until it is paid for.

Option 3 – New Team at a Returning School/Organization

- Step 1:** Browse to <https://www.robotevents.com>.
- Step 2:** (Returning School) If you already have an account, click "Login".
- Enter your email and password and click "Login".
- Step 3:** Check to ensure that the correct year is listed in the "Season" dropdown menu on the right-hand side. Click the "Register a Team" button.
- Step 4:** Select the circle next to the program in which you wish to register, either "VIQC Team Registration," "VRC Team Registration," or "VEX U Team Registration." Then click the "Next" button.

Note: You will have to repeat this step if you are registering multiple teams.

Step 5: You will now see a list of eligible teams and team numbers that you have registered previously. Click the “Add Another Team” button next to the team number in which you would like to register a new team. Please note the following regarding how team numbers work:



As such, all teams in a single program (VIQC, VRC, or VEX U) from a school or organization should have the same base number.

- Step 6:** Update any details of your school/program in the organization information panel. Click the “Next” button.
- Step 7:** In the team information panel, your team number will already be entered and cannot be changed. Choose the letter you wish to associate with this team from the dropdown menu next to team number.
- Step 8:** Verify or adjust details of the demographics of your team as well as your sponsor’s name and emergency contact info. Then click the “Next” button.
- Step 9:** Verify or update contact information in the contacts panel. Click the “Next” button.
- Step10:** Verify or update details of your team, including team and robot name, in the team profile panel. Add social media information if applicable.

Note: You can change this later or year-to-year.

Step 11: Click "Finish" to complete the registration process for this team. Your team’s registration will now be added to your cart for checkout. Please note that your team’s registration is not complete until it is paid for.

- After registering, your cart includes your team(s) registration(s).

Stage 2. Forms, Policies and Procedures

Participant Release Form

All team participants (players, coaches, and mentors) must complete the Participant Release Form as instructed on the form. The form is submitted by uploading to the team profile on RobotEvents.com. Once your team completes the form electronically, it is applied automatically to every official REC Foundation event the team registers for during the current season.

- English Version:
 - ➔ <https://www.roboticseducation.org/documents/2018/03/participant-release-form.pdf/>
- Spanish Version:
 - ➔ https://www.roboticseducation.org/resources_library/participant-release-form-spanish/

Student-Centered Policy

At REC Foundation competitions, teams of students showcase their knowledge and skill in designing, building, programming, driving and strategizing during match play and skills challenges. The Student-Centered Policy assures that all these activities are completed by the students with minimal adult assistance.

The Student-Centered Policy addresses the expectations for organizations and their team members. It contains examples of activities for transparency and to encourage student learning opportunities. Frequent review of the REC Foundation Student-Centered Policy is encouraged as there are penalties for teams violating the policy.

To view the Student-Centered Policy, please see the following link:

- ➔ <https://www.roboticseducation.org/studentcenteredpolicy>

Code of Conduct

The REC Foundation considers the positive, respectful, and ethical conduct of all students, teachers, mentors, parents, and other event attendees an important and essential component of all REC Foundation sanctioned events. All stakeholders should review the expected behavior and ethical standards for all REC Foundation sanctioned events and become familiar with the reporting and violation procedures.

To view the Code of Conduct, please see the following link:

- ➔ <https://www.roboticseducation.org/codeofconduct/>

Stage 3. Before the Build: Starting A Team

Use the following resources to help your team get started in enjoying an amazing learning experience in one of the REC Foundation's robotics programs.

Develop Your Team

There is no maximum to the number of students who can participate on a robotics competition team (Note: See appropriate Game Manual, links below, for the minimum number of student drivers required to participate). Keep the amount of your available resources and space in mind when developing your team, since students benefit most from a well-supported hands-on learning experience. If your student interest exceeds available resources, consider recruiting additional support and space to coordinate multiple teams or try the Online Challenges. The registration fee for additional teams in the same program (VIQC, VRC or VEX U) and school/organization is discounted.

- VIQC Average Team Size: 4-6 students
- VRC Average Team Size: 5-7 students
- VEX U Average Team Size: 4-10 students

For questions regarding Team and Student definitions, please reference the Game Manual for the Current Game Challenges:

- **VIQC:** <https://link.vex.com/docs/VIQC-rise-above/GameManual>
- **VRC & VEX U:** <https://link.vex.com/docs/21-22/vrc/tipping-point/Game-Manual>
- **VEX U:** <https://content.vexrobotics.com/docs/21-22/tipping-point/AppendixC-1.0.pdf>

Equipment for Your Team

VIQC and VRC robots may only be built with official VEX products. VEX U competitions, however, allow for a variety of parts. Please consult the game manual for exact rules about robot parts and equipment.

Your team needs a VEX robot kit, access to a computer/device, and the Internet to utilize the free online curriculum and programming resources. The number of robots that your team requires depends on the number of students, the hands-on learning experience you plan to facilitate, and your available resources. Additional VEX components are available for purchase separately from the kits if your team chooses to add to their design and building options.

The last optional items to consider purchasing are the Field and Game Elements for the new robot game each season. They are available for purchase after VEX World Championships, usually in early May. You may purchase all or part of the robot game elements or even make your own!

Contact your TEM on the best methods for purchasing VEX products as vendors vary from region to region.

Note: Some Field and Game Elements are approved for use in building a future VEX robot. This is particularly true in VIQC. See the Game Manual for details.

Assemble a Tool Kit

Other than your robot kit and your team members, it's a great idea (but not mandatory) to have tools for use with your robotics parts.

For VIQC teams, you may want the VEX Pin Tool, a small Philip's head screwdriver, sealable bags or plastic compartmented storage and a tape measure. Each situation is different and knowing your own space, storage needs, and set-up is paramount.

For VRC teams, you may want extra wrenches, tethers, rechargeable battery packs, and other spare parts if your team budget allows for it. A few basic hand tools, like tin snips, a hacksaw and a metal file for sharp edges are good to have handy as well. Always be sure that everyone wears safety glasses while working on the robot and during competition matches.

For VEX U teams, the competition allows for the use of additional machining and fabricating tools. The most common equipment addition to a VEX U team is a 3D printer.

Fundraising

While our programs remain among the most affordable available, the REC Foundation realizes that expenses over a season can add up and we want to lend assistance when possible. We are pleased to offer our community a selection of resources to help support your team and program all season long. Please consider visiting our webpage for some unique offerings to get the boost you need to keep your team competitive!

➔ <https://www.roboticseducation.org/fundraising-resources/>

VEX Robotics have also created an article in their Knowledge Base which links to regional funding sources that may be available to you.

➔ <https://grants.vex.com>

Registering Your Team for Competition Season

Important Note: If you haven't already, remember to register your teams early following the guidelines provided in [Stage 1. Team Registration!](#)

Plan Your Schedule

In order for your team to be effective, develop a schedule that meets your team's availability, needs, objectives, and resources and stick to it! For younger students, it may be helpful to limit meeting length to less than two hours. Some teams meet once or twice per week for a few hours, while others will meet more frequently and for longer periods of time. Teams benefit from the program proportionally to the effort they put into the program. As events approach, your team may decide to meet more frequently in order to better prepare for their participation in the competitions.

Plan Your Team Meetings

During the initial meetings, it is helpful for your team to develop a list of goals and a timeline for accomplishing these goals. Record these goals and deadlines in the team's engineering notebook (see details in the next Stage, [Step 1: Engineering Design and Documentation](#)) and assign someone on the team to keep track of the team's progress. Using a planning process supports the development of invaluable organizational, time management, and project management skills in your students.

Assign Team Roles

Teams can vary in size. Your team is more productive if everyone is assigned a role. Consider rotating roles so that team members can benefit from the full program experience. Assign or have the students choose the roles that best fit their interests, skills, and needs. It is common for a student to perform more than one role on a team.

Robotics Team Role Suggestions:

- Robot Designers
- Robot Programmers
- Engineering Notebook Manager
- Robot Builders
- Robot Drivers
- Team Scouts (particularly for VRC)
- Online Challenge competitors

OPTIONAL:

Additional Robotics Team Role Suggestions:

- Team Captain(s)
- Outreach Coordinator
- Fundraising
- T-shirt Designer
- Videographer
- Web Designer
- Pit Manager

Tip: Consider assigning backup roles in order to sustain your team when an illness or schedule conflict occurs.

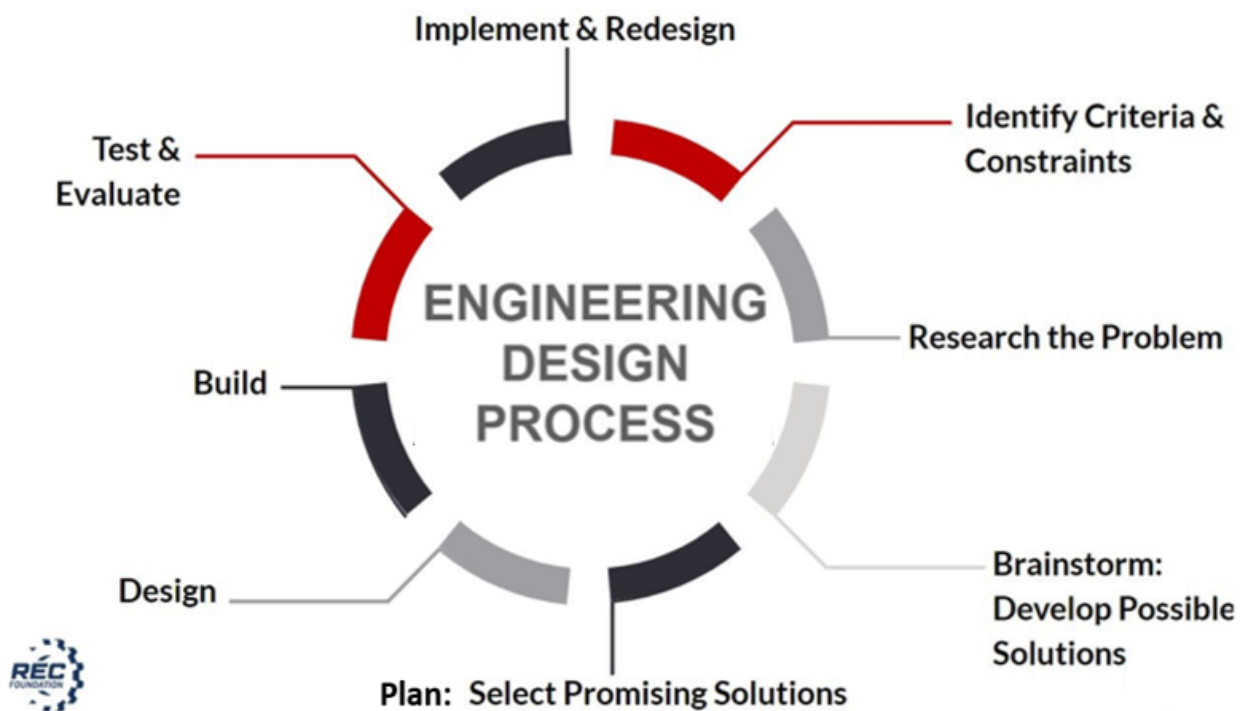
Develop a Team Identity

Developing your team identity can be a valuable, fun part of the team building process. Your team members should use their creativity to establish their own unique identity. Developing a team identity can include choosing a team name, creating displays for your pit space (more information on Pits in [Stage 5. Attending An Event](#)), designing a team shirt, or creating a team cheer or song. These activities need not cost a lot to foster great teamwork, team spirit, and a strong sense of community. The more you celebrate your team's efforts and accomplishments, the easier it will be to engage other students and potential supporters that will help you build your team's robotics program.

Stage 4. Build Time!: Engineering Design Process

Step 1: Engineering Design and Documentation

Engineering Notebook: A book in which an engineer (or engineering team) formally documents, in chronological order, all the work associated with a specific design project. Robotics teams receive a sample notebook with their registration, but any bound notebook is allowed.



The REC Foundation believes that the use of engineering notebooks exposes team members to a variety of critical life skills including project management, time management, brainstorming and teamwork. Documenting the engineering design process helps students acquire real-world life skills that will benefit them in their academic and professional futures. There are many documentation models, so investigate and use the one that fits your team.

Successful engineering requires effective and efficient communication and documentation. While it isn't mandatory, we encourage having team members document the design process using an engineering notebook. The notebook provides teams with a tool to:

- Document the team's engineering design process throughout the season.
- Assign task(s) to complete.
- Assess/evaluate through testing.
- Enter sketches, pictures, calculations and programming notes.
- Document a team's experience as they prepare for the competitions.
- Continue to document their design analysis and their final building process including any iterations of the design they may go through over the season.
- Project management including:
 - **Time management** – How the team uses the time of team members and mentors.
 - **Scheduling** – What is the timeline the team sets out for the entire season.
 - **Resource Management** – How the team uses the financial resources, technical resources and expertise available to it.

Each notebook is created through a concerted effort by a team to document their design decisions. Throughout the season, many larger events send their Design Award and Excellence Award winners to Regional Championships that qualify for the World Championship. Be aware that a design notebook is required to be considered for either the Design or Excellence Award at VEX World Championships and local events. Start your notebooks early and update them often.

Judge Guide Tip – All Engineering Notebooks should contain these elements:

- Team number on the cover
- Written in ink with errors crossed out using a single line (so errors can be seen)
- All pages intact; no pages or parts of pages removed even if they contained errors
- Each page numbered and dated in chronological order
- Each page signed by student author
- Team meeting notes as they relate to the design process
- Pictures, CAD drawings, documents, examples of code, or other material relevant to the design process are glued into the notebook (tape is acceptable, but glue is preferred)

Judge Guide PRO Tip – Outstanding Engineering Notebooks contain these additional elements:

- Table of contents
- Each page signed by a student witness as well as student author
- First entry is the first team meeting, and each team meeting has an entry
- Descriptions of brainstorming sessions
- Descriptions, sketches, and pictures of design concepts and the design process
- Observations and thoughts of team members about their design and the design process
- Records of tests, test results, and evaluations of specific designs or design concepts
- Team organization practices as they relate to the design process
- Project management practices including their use of personnel, financial, and time resources
- Notes and observations from competitions to consider in the next design iteration
- Descriptions of programming concepts, programming improvements, or significant programming modifications

Ultimately, your best Engineering Notebooks allow for a person unfamiliar with the team’s work to recreate the robot’s design and program based only on the information in the Notebook.

Step 2: Research and Brainstorm the Game

Learn the Robot Game Rules

Have the team learn about the current game rules by reviewing the Official Game Manual. The Game Manuals are linked previously in the Guide ([Stage 3. Develop Your Team](#)) and are also available on the mobile apps, VIQC Hub and VRC HUB.

Brainstorm

After your team members learn about their current game challenge for the year, they will be excited to start building a robot! However, we encourage your team to develop and use a brainstorming process before any building starts so that a variety of approaches is considered. If your team begins the building process too soon, an effective strategy and design idea may be missed. One simple way to brainstorm is to have the team list all of its strategies and designs ideas and then categorize them by “Need, Want and Wish.” Thus, if your team only has time to accomplish its “Needs” by the time a competition rolls around, it is still competitive. Later, your team can get to the list of “Wants” and “Wishes” as time allows. Remember, this is only one of many viable brainstorming processes a team can use.

If you have team members who have never built a robot before, it is a good idea to have them work through some STEM Labs or other curriculum offerings located on the following pages.

- **VEX IQ STEM Labs:**
➔ <https://education.vex.com/stemlabs/ig>
- **VEX V5 STEM Labs:**
➔ <https://education.vex.com/stemlabs/v5>

VEX provides a “Hero Bot” every year that is a basic, first prototype for that year’s challenge. Note: The current year’s Hero Bot is the first robot listed but your team can build the past seasons’ Hero Bots to learn additional designs, linkages and mechanisms.

- **VEX IQ Downloads:**
➔ <https://www.vex.com/ig/robot-builds>
- **VEX V5 Downloads:**
➔ <https://www.vex.com/v5/robot-builds>

Step 3: Prototype and Design the Robot

Design Your Competition Robot

Before your team designs their robot, there are a few things teams should consider:

- Follow all game rules as outlined in the official game manual.
- Carefully review the list of allowed materials for building the robot. Specifics for each program can be found in the game manual for each competition level and should have been reviewed in Step 2. VEX U teams should be aware that utilizing selected manufacturing capabilities that may be available at your institution is allowed if the team desires to do so.
- Search the Official Q&A forum first and, if you don’t see your answer, post a question to get the answer. The Official Q&A Forum is located on RobotEvents.com and the Primary and Secondary Team contacts can post questions to clarify game rules. Find the Q&A Forum by clicking on the “Robot Competitions” drop down menu and selecting the program in which the team is participating. The Q&A Forum is accessible via the blue box near the top.
- Ask technical questions at <https://www.vexforum.com/>. Some answers may already be there, so do a quick search first.
- Robotics experience is not necessary. A supportive community is ready to assist. Contact your TEM on how to get linked into that community.
- VEX Knowledge Base articles are available at help.vex.com.

Programming the Robot

In addition to driving the robot to solve challenges, your team programs the robot to complete tasks by using programming software and sensors. Your team can test their skills at an event in the Programming Skills Challenge while documenting their learning process in the Engineering Notebook.

VEX offers a variety of robot programming options that use Blocks and Text (VEXcode IQ and VEXcode V5) right through to an advanced platform (VEXcode Pro V5) that provides professional level coding. More information is available here:

➔ <https://www.vexrobotics.com/vexcode-download>

VEX Robotics Bonus Feature: VEX offers a great virtual learning tool for programming with VEXcode VR. Check it out at ➔ <https://vr.vex.com>

Step 4: Test, Troubleshoot and Iterate

Test & Iterate

The great thing about the robotics design systems is having the ability to build, test, and iterate a design in a rather rapid fashion. Many great designs in our world took many, many attempts to perfect. While iterating, encourage team members to make only one change at a time and to document the impact of the change. While this may seem overly burdensome, it is the best process to document design changes and their results. Design is an iterative process, so embrace the notion and keep going until the team's robot system or mechanism yields the expected, repeatable, desired behavior.

Note: When testing new programming code, always save new code under a new filename. Programming files are small and take up almost no hard drive space, so develop a naming system and stick with it throughout. You never know when something won't work, and you'll regret having to recreate something that already worked well.

It is also important to remember that the design and programming phases can be difficult, and these processes almost never go as planned, especially in earlier iterations. Always treat a "failed" design as an opportunity to learn and try to make sure all team members walk away with something positive each time you meet. Learning key interpersonal skills and perseverance is every bit as important as any engineering, programming or design knowledge gained by the students on your team.

Troubleshooting

Sometimes, things don't go as planned, and we need a little assistance. The VEX Robotics Knowledge Base, is a library of information about all things robotics. The purpose of the Knowledge Base is to help users quickly find information about products, services, or topics. Always check the knowledge base on the VEX website by typing help.vex.com and searching for what you need.

- **VIQC troubleshooting link:**
➔ <https://kb.vex.com/hc/en-us/categories/360002324792-IQ>
- **V5 troubleshooting link:**
➔ <https://kb.vex.com/hc/en-us/categories/360002333191-V5>

Battery Example: Have red lights on your battery? Type “Battery” in the knowledge base search engine and choose the article: Battery Lights, Errors - Electronics for V5 or Indicator Lights - Battery- VEX IQ for VEX IQ. Still unsure? Type “Battery” and choose the article: Battery Medic.

Controller Example: Type “controller” in the search prompt for answers to common controller problems. Add other keywords to the search engine to be more specific. Here are a few common errors:

- Controller needs to be calibrated.
- Firmware needs to be updated.
- Functioning on Bluetooth when it needs to be VEXnet.
- Controller needs to be reset.
- Controller and brain need to be paired.

Brain Example: Type “brain” in the search prompt for answers to common brain problems. Add more keywords to narrow down your search. Here are few common errors:

- Firmware needs to be updated.
- Functioning on Bluetooth when it needs to be VEXnet. (Must be VEXnet to run on a VRC competition field.)
- Controller and brain need to be paired.
- Program did not properly load.

Step 5: Get Ready to Compete!

Event Registration

Register to participate in one or more events during the season. Details of scheduled events are updated throughout the season on www.RobotEvents.com. Teams must first pay their team registration fee (see [Stage 1. Team Registration](#)) for the season before registering for a competition event. Competition event registration fees vary by event, but usually range from free scrimmages, to \$50-\$100 for qualifying events, to even higher with Signature and Championship events.

Events can fill up quickly. Be sure to plan your season and register for events early so that students and their families plan accordingly. If an event fills early, you can add your teams to the Waitlist Tab of the event and possibly be added as space allows.

Note: Events are run by an Event Partner (EP). The EPs contact information is found on RobotEvents.com under the “General Info” tab. This is the resource for all event-based questions.

Event Types

Workshops: Workshops are non-qualifying* events that provide in-person or online opportunities to gain skills, promote STEM, and inspire students.

Tournaments: Tournaments are the most common event type and are qualifying* events. Tournaments are typically one day events that feature Qualification Matches followed by Finals (VIQC) or Elimination Matches (VRC/VEXU). In most cases, judged awards are offered and judging for awards runs concurrently with the event. Tournaments without judged awards are allowed and may be an easier alternative for new EPs or for EPs that want to offer an additional event with fewer volunteers.

Note: There is also a Live Remote Tournament (LRT) option that allows for competitions with teams across the world. Contact your Event Engagement Manager for more information.

Scrimmages: Scrimmages are like Tournaments but are non-qualifying* events that are typically one day events to give teams an additional opportunity to test their robot designs.

Leagues: Leagues are qualifying* events that are like Tournaments but provide multiple opportunities for a group of teams to participate in robotics events. Instead of one day of events and judging, the League is spread out over four (4) or more league sessions spaced over several weeks or months.

Note: Some leagues may be set up as non-qualifying “scrimmages” depending upon the region.

Signature Events: Signature Events provide students with an opportunity to experience a world-class event with teams from outside of their normal event region. These events have stricter requirements than regular tournaments to give teams a mini-VEX World Championships like experience. Signature Events are qualifying* events and qualify teams directly to the World Championship Event.

Championship Events: Teams must qualify at a prior event to attend a Championship Event. Some Championship Events are qualifying* events. Go to the Awards Tab of the event on RobotEvents.com for more information. Contact your Event Engagement Manager (EEM) for more information about your region's Championship Event.

* Qualifying is a term used to signify that a team winning certain awards at these events (per the Awards Tab on RobotEvents.com) are invited to move on to the next level of competition, culminating in the VEX World Championship.

Early Bird Registration is a preferential registration period that allows teams to register if they have fewer than two (2) tournament registrations during the current season. In event regions with a high density of teams, this provides a fair chance for teams to register for at least two (2) tournaments. Early Bird Registration is only enabled for qualifying, non-championship tournaments in event regions with a high density of teams as determined by the REC Foundation EEM. If Early Bird Registration is not enabled, the entire tournament registration period is Standard Registration. Contact your EEM to determine if Early Bird Registration is enabled for events in your region.

A team's eligibility for Early Bird Registration is determined by counting the number of qualifying, non-championship tournaments the team has registered for during the current season, whether the team registered during Early Bird or Standard Registration. Teams are eligible to register during Early Bird Registration if they have registered for fewer than two (2) tournaments during the current season. Team registrations for these events do not count towards a team's Early Bird Registration eligibility for:

- Any waitlist registration
- Leagues, Scrimmages, Workshops
- Championship and Signature Events (events that qualify directly to VEX World Championship)
- An Event Partner's team registered for that Event Partner's tournament

Getting Ready for Competition

After your team completes the robot build and programming (following all game rules and guidelines carefully), and has practiced with the robot, it is time to get ready for competition. It is common for teams to get nervous before their first ever competition, but it is one of the most important learning experiences in the process. Do not back out and miss the lessons that are about to be learned. Here are a few critical steps that your team will want to complete to be ready for competition:

- Review the rules and run through the Inspection Checklist about a week before competition so there is ample time for adjustments.
 - **VIQC Inspection Checklist:**
 - ➔ https://www.roboticseducation.org/resources_library/vex-iq-challenge-robot-inspection-checklist/
 - **VRC Inspection Checklist:**
 - ➔ https://www.roboticseducation.org/resources_library/vrc-robot-inspection-checklist/
 - **VEX U Inspection Checklist:**
 - ➔ https://www.roboticseducation.org/resources_library/vex-u-robot-inspection-checklist/
- Check the Official Q&A Forums for rule clarifications.
- Visit the event's page on Robot Events and read it carefully. Specifically, look for details about your team's pit area, available concession areas, electrical sources, and any venue-specific rules.
- Review the descriptions and criteria for the awards that are given during the tournament.
- Prepare to answer questions from the Judges (see [Judging section](#)).

- Pack for the event the day before the day of departure. Most competition days start early and it's easy to miss something when in a rush. Here are some items that the team will definitely need:
 - Safety glasses (VRC/VEX U)
 - Spare parts & tools
 - Batteries and chargers
 - Programming cable
 - Laptop computer
 - Engineering Notebook
 - Banners and other decorations for your team pit
 - Giveaways (if you have them)

Using Resources

Please know your entire experience as a robotics team is fully supported by the Robotics Education & Competition Foundation staff, Event Partners, volunteers, and your fellow teams. Please utilize the resources and ask questions as needed.

- Review information from community members on the VEX Forum
 ➔ www.vexforum.com
- Read about the competition awards in the Awards Appendix found on the Event Documents pages. See the [Awards](#) section of this Guide for more information.
- Check out the VEX Knowledge Base for your program for common questions and topics.
 ➔ help.vex.com
- Download the VEX Robotics app so that you can easily read and search the current game manual
 - **VIQC Hub App:**
 ➔ <https://www.roboticseducation.org/app/vex-iq-challenge-hub/>
 - **VRC Hub App:**
 ➔ <https://www.roboticseducation.org/app/vrc-hub/>

Celebrate Your Team's Hard Work

After each event, be sure to celebrate your team's accomplishments. Every team has room to grow and improve, but the experience and knowledge that your team gains from participating in an event is worthy of a great celebration. Consider inviting sponsors, teachers, and community members to a post-event celebration. This is an excellent opportunity for your team to share what they have learned, plan their participation in more robotics learning experiences, and develop community support for their efforts.

Stage 5. Attending an Event

Safety Procedures at Events

Safety of participants is always a major concern at a robotics event both within the venue and outside the entrance as well. As always, common sense should prevail. Below are just a few of the safety practices participants and guests should follow.

Outside the Venue:

- It is always a good practice for students to travel in groups, never alone.
- Have a basic understanding of entrances and exits to the building. If a map is available, keep it on hand.
- Be aware of the traffic flow and walking hazards to and from your transportation.
- Keep your vehicles locked.

Inside the Venue:

- If you have physical limitations, contact the Event Partner for possible accommodations.
- Always know where First Aid and safety devices are located.
- Assign a person to safety for your team at the event.
- Keep your pit area clean and neat. Store all tools and sharp objects when not in use. Avoid trip hazards by keeping the floor clear.
- Check with the Event Partner on where to connect your battery chargers.
- Work on your robot in your pit area. Do not work on your robot in aisles.
- Do not create any structures in your work area that may fall over.
- When testing your robot, be aware of your surroundings and people standing nearby.
- Appropriate shoes must be worn always. Open-toed shoes and sandals are highly discouraged.
- Running, pushing, shoving and other aggressive behavior must be avoided.
- Keep trash and other debris picked up.
- Report any safety concern to the Event Partner.

For VRC/VEX U Competitions Only:

- When working on your robot, be careful of pinch points and sharp edges.
- Power tools such as die grinders, reciprocating saws, and lathes are generally not allowed. Check with the Event Partner before bringing them to an event.
- Any tool that creates sparks should not be used. I.e. A Dremel should be operated at speeds that do not create sparks.
- Appropriate eye protection is recommended anytime a tool that has rotational motion is powered on and when working on or driving a robot.
- Safety glasses are required for all drive team members on the field and are highly recommended in the pit areas.

What to Expect at an Event

Tournaments are busy, fast-moving days. Here are a few tips to help teams enjoy the day:

- Make sure your team is well rested and well hydrated. Bring snacks that are non-perishable.
- Dress comfortably and wear closed-toed shoes. Wearing team shirts or costumes adds to the fun.
- Ensure that your robot is charged and ready for action!
- Make sure all equipment and parts are labeled with your team/contact name or team number.
- Arrive a few minutes early, if possible, and become familiar with the event venue.
- Ensure that an adult associated with the team supervises the students throughout the event.
- Review the event agenda and match schedule. Make sure the students know their team number.
- Assign a timekeeper, who ensures the team arrives on time for their matches.
- Encourage your team to interact and share with other teams to enhance their learning experience.
- Demonstrate courtesy and respect to the dedicated event staff and event participants at all times.
- Offer positive support and encouragement throughout the day.
- Share your team spirit! HAVE FUN!

Key Terms

Check-in

When a team arrives at a tournament, they must check in. Each event has a designated check in area where coaches let the event partner know they arrived. The coach receives any pertinent information including inspection sheet, schedule and pit map.

Team Pit Area

A designated area for coaches and teams. Each pit area has a team table and either access to an outlet or a charging area. This pit area is where teams work on their robot, wait for matches or be interviewed by the judges. Pit tables are clearly marked with the team's designated team number.

Inspection

When a team arrives at a tournament, they must go through a robot inspection to ensure the robot is in compliance with regulations related to size, parts (proper amount and usage of parts, no sharp edges, no modifications, etc.), and field control guidelines (correct version of the software and competition template loaded). What is legal or not is defined within the Game Manual. Inspections usually take about 30 minutes but can take longer, so you'll want to allow for enough time. Inspection Checklists links are found in [Getting Ready for Competition](#).

Event Meeting

An event meeting is typically run by a Head Referee and/or the Event Partner. All participants including students, coaches and other adults associated with the team are expected to attend. In this meeting, safety, rules, and behavioral expectations are reviewed. Event-specific information, like where to line up and/or any adjustments to the schedule, are also provided.

Judging

Teams of students showcase their knowledge and skill in designing, building and programming their robot. As part of many events, volunteers review all submitted engineering notebooks, observe team performance and conduct team interviews. The criteria to determine the winners of the Judged Awards is in the Judge Guide here:

➔ https://www.roboticseducation.org/resources_library/judge-guide/

Qualifying Matches

The Qualifying Match schedule is available once all teams are checked in. This schedule shows the randomly assigned Alliances and Qualifying Matches pairing of teams. For tournaments with multiple fields, the schedule also indicates on which field the Match will take place. Qualification Matches are used to determine rankings for the Finals Matches (VIQC) and Alliance Selection (VRC/VEX U).

Note: Qualifying Matches differ between VIQC, VRC and VEX U.

VIQC Teamwork Challenge: Each one (1) minute match consists of two teams, operating as an alliance, to score maximum points. Both teams earn the same combined score. This score is averaged with the other Qualification Match scores earned by the team with other alliances.

Note: The lowest score is dropped from the average for every four (4) Qualifying Matches played.

VRC Competition: Each two (2) minute match consists of two teams as the Red Alliance and two teams as the Blue Alliance. Teams put on either their red or blue VRC license plates, placed on opposing sides of their robot, to indicate their alliance. Each match starts with an autonomous period, followed by a driver-controlled period. The alliance to outscore the other is the winner of that match.

Tips:

- Find your alliance partner before the match to develop a game strategy and ensure your partner arrives at the match on time.
- Keep track of the current match number being played and arrive at the queuing area early with your alliance partner.

VEX U Competition: The VEX U matches are similar to the VRC matches except each team brings two robots to form their own alliance.

Robot Skills Matches

During most events, teams have an opportunity to participate in Robot Skills Matches. These are usually held on a separate field near the competition fields or on the main field in the morning. Teams should check the event agenda to determine when the Robot Skills field opens and closes. Most events run the Robot Skills matches on a first-come basis, so teams should plan accordingly to ensure they get their Robot Skills matches completed.

There are two types of Robot Skills Matches.

- **Driving Skills Match:** A Driving Skills Match consists of a sixty (60) second Driver Controlled Period. There is no Autonomous Period.
- **Programming Skills Match:** A Programming Skills Match consists of a sixty (60) second Autonomous Period. There is no Driver Controlled Period

A team's Robot Skill score is determined by the sum of their highest Driver Skills Match and Programming Skills Match at the event. Remember, Robot Skills matches are optional, but highly recommended since many awards utilize Robot Skills ranking and may be used to fill Championship qualifying spots. Teams should review the Robot Skills Appendix of the Game Manual because some rules or scoring may be different compared to Qualification Matches.

Tournament Finals, Part 1: Alliance Creation/Selection

At VIQC and VEX U events, alliance selection is an automated process. For VIQC events Tournament Manager assigns alliances for the final teamwork matches based on qualification rankings of teams (1st and 2nd form Alliance 1, 3rd and 4th form Alliance 2, etc.) and for VEX U events, each team serves as its own alliance since VEX U teams compete with two robots in every match.

For VRC events, after the Qualifying Matches, the top-scoring teams choose their alliance partners for the Elimination Matches. The goal of alliances is to pair teams that are good compliments so that they can outscore their competitors during the Elimination Matches. One member from each of the top-scoring teams is chosen as a Team Representative to participate in the Alliance Selection process. The Team Representative has a discussion with the team's Lead Strategist and Scouts about what they think could make the most beneficial alliances.

VRC Alliance Selection: The process of choosing the permanent Alliances for the Elimination Matches. Alliance Selection proceeds as follows:

1. The highest ranked Team at the end of Qualification Matches becomes the first Alliance Captain.
2. The Alliance Captain invites another Team to join their Alliance.
3. The invited Team Representative either accepts or declines as outlined in the Tournament Rules section of the Game Manual.
4. If a Team Representative declines an Alliance Captain's invitation during Alliance Selection, that Team Representative may not accept a later Alliance Captain's invitation. However, they are still eligible to play Elimination Matches as an Alliance Captain.

5. The next highest ranked Team becomes the next Alliance Captain and repeats the process until all alliances are full. Unchosen teams do not participate in the Elimination Matches.
6. Teams should refer to the posted Elimination Bracket to determine the order of the Elimination Matches and their alliance color.

Note: The number of teams participating in the Finals/Elimination Matches is determined by the Event Partner based on the guidelines specified in the Game Manual.

Tournament Finals, Part 2: Determining a Winner

At **VIQC events**, after all alliances are formed, each alliance competes one more time to achieve a maximum score. The alliance that scores the highest score with this additional Finals attempt is declared the winners!

For **VRC and VEX U events**, Red Alliances and Blue Alliances face off against each other in a “bracket” format; the winning alliance moves on to the next round until one alliance has won over all opponents. Any ties will result in additional Matches until one Alliance wins and advances. If a team is disqualified during an Elimination Match, then their alliance partner is also disqualified, and the match is recorded as a loss. The bracket continues to converge with winners moving on until a Tournament Champion alliance is declared!

Note: Both teams in the winning alliance are acknowledged as a winner of the tournament.

Awards

There are three types of awards: Performance awards, judged awards, and individual awards. Not all awards are offered at all events. The Event Partner provides a list of the awards offered at the event on RobotEvents.com under the “Awards” tab. For details on the awards go to the end of the Judge’s Guide found here:

➔ <https://www.roboticseducation.org/judgeguide/>

Rankings

After your team attends an event and participates in the Robot Skills Matches, those scores are compared to the scores of teams from around the world! Check out where your team stands in the World Skills Rankings by following these links (sort by grade level):

- **VIQC** – <https://www.robotevents.com/robot-competitions/vex-iq-challenge/standings/skills>
- **VRC** – <https://www.robotevents.com/robot-competitions/vex-robotics-competition/standings/skills>
- **VEX U** – <https://www.robotevents.com/robot-competitions/college-competition/standings/skills>

Bonus: Additional REC Foundation Information

As you read through this guide, you may notice that there is more to coaching a robotics team than building/programming a robot and competing at an event. The REC Foundation has created a full experience for you and your team that includes free classroom curriculum, free professional development, a supportive robotics community, STEM related Online Challenges and a life-changing experience for your students. If you made it this far, here are additional tools and information about the REC Foundation. Contact your TEM if you want to get more involved!

REC Foundation Inclusion Initiatives

The REC Foundation is committed to engaging every student, especially those in underserved populations, in the pursuit of STEM education and careers to prepare them for the challenges and demands of the future workforce. As part of this commitment, special initiatives of the Foundation are designed specifically to impact these underrepresented populations. Ask your TEM for more information on all of the REC Foundation Inclusion Initiatives.

REC Foundation Sponsors

The Robotics Education & Competition Foundation is grateful for the generous support of our sponsors who partner year-round to provide team grants, and support local tournaments, state championships, and the VEX Robotics World Championship. We value their commitment to advancing student interest and engagement in STEM.

- **Presenting Sponsor:** Northrop Grumman Foundation
- **Global Sponsors:** Google, TESLA, Rack Solutions, Toyota, Texas Instruments, VEX Robotics, Dell, AutoDesk, NASA, TVA, Innovation First International, RoboMatter, HEXBug
- **VEX World Championship Presenting Sponsor:** Northrop Grumman Foundation
- **VEX World Championship Sponsors:** MathWorks, UPS, RobotMesh, Nordson, Nissan, Microchip
- **Regional Sponsors:** Intel, Palmetto Partners, Volvo, TVR, Cheniere

REC Foundation Grants

Need help getting the equipment to start teams? Contact your TEM about REC Foundation grants! There are a variety of grants that may be available including Matching Team Grants, Girl Powered Grants, Regional Grants and more.

Online Challenges: Get Everyone Involved

The Online Challenges are another great component of REC Foundation robotics competitions. These challenges are free for registered teams and provide additional opportunities for students to become involved with the program and enhance the student's STEM learning.

There are several Online Challenges for teams to be involved with each season. Additional information about these challenges can be found at:

<https://challenges.robotevents.com/>

Acronym Guide

- **CAD:** Computer-Aided Design
- **EEM:** Event Engagement Manager
- **EP:** Event Partner (The person running the event)
- **“Hero” Bot:** VEX’s robot design that is built for yearly challenges (See Brainstorm section)
- **GP:** Girl Powered
- **LRT:** Live Remote Tournament
- **NGF:** Northrop Grumman Foundation, presenting sponsor for VEX World Championship
- **REC Foundation:** Robotics Education & Competition Foundation
- **STEM:** Science, Technology, Engineering, Mathematics
- **TEM:** Team Engagement Manager
- **TM:** Tournament Manager (The software running all aspects of the competition)
- **V5:** VRC and VEX U robotics platform; sometimes used interchangeably with VRC (See VRC)
- **VEX:** Not an acronym! Just a cool name. We get asked this a lot.
- **VEX IQ:** VEX IQ robotics platform; sometimes used interchangeably with VEX IQ Challenge (See VIQC)
- **VEX U:** VEX College & University Competition
- **VIQC:** VEX IQ Challenge
- **VRC:** VEX Robotics Competition

Social Media

We welcome coaches, teams, teachers, and others to connect with us on our social media channels. We welcome you to share news from your events, your team meetings, activities you participate in and more!

Follow us:

- **Facebook** and **Instagram:** @RECFoundation
- **Twitter:** @REC_Foundation
- **LinkedIn:** Robotics Education and Competition Foundation

Use the following hashtags on [Instagram](#), [Twitter](#), [Facebook](#), and [LinkedIn](#):

- #VEXworlds
- #OMGRobots
- #RECFoundation
- #RoadToVEXworlds
- #VRC
- #VEXIQ
- #VEXU
- #VEXrobotics
- #GirlPowered