How to Start and Organize a VEX U Robotics Team

Overview

This document has been created to help new teams get started with the VEX U Robotics Competition. If after reading this document, your team still has questions about getting started, please feel free to visit www.roboticseducation.org for more information or contact your local Regional Support Manager by visiting www.robotevents.com/support.

Getting Started

Congratulations on making the decision to join the VEX U Robotics Competition; a fun, dynamic, and competitive environment. There are several websites that your team should visit in order to get started.

Registration: To register your team visit www.robotevents.com and choose the VEX U- VEX Robotics button. Then select the "Register a Team" button and follow on-screen instructions to register your team for $150 for each team registered at a school/organization. Once payment is received, teams will receive a Welcome Kit that includes the sample game elements, team license plates, and an engineering notebook.

Equipment: Review the VEX EDR robot kits & parts: www.vexrobotics.com.

Game rules: Learn about the current game at http://www.roboticseducation.org/competition-teams/vex-u/. Emphasis should be placed on reading Appendix E which specifies the unique rules for the VEX U program.

When and where to play: Find events near your team: www.robotevents.com. This is a dynamic listing that is updated throughout the season, so check back for additions. Each event listing will provide you with the details that you need to know for each event.

Communication: Communicate and collaborate with the VEX Community: www.vexforum.com/.

Additional Tools and Assistance: The VEX Support overview http://www.vexrobotics.com/vexedr/edr-support-overview is the home of additional support materials that are divided into categories for Firmware, FAQs, and additional resources.

Plan Your Schedule

In order for your team to be effective, develop a schedule and stick to it. 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 will benefit from the program proportional to the effort they put into the program.

Create a schedule that suits your interest, objectives, and available resources. If possible, be ready to adapt to changing interest levels.

Plan the Team Meetings

Team building should exist alongside design work for your team. However, it is really important that teams structure their meetings and develop project timelines. During your first or second meeting, it is highly suggested that the team develop a list of specific goals with deadlines. Don't forget to allocate plenty of time to test/iterate and learn to drive and test programming. Record these goals and deadlines in the engineering notebook (details on page 4) each team receives and assign someone on the team to keep track of the team's progress.

Assign Team Roles

VRC teams vary in size. While some teams start out small, they often grow over the years. In order for your team to be productive, it is important to assign everyone on the team a job.

Note: The following roles should be considered when forming a team and making assignments.

- Advertising and Public Relations
- Captains
- Builders
- Handout Developers
- Drive Team Builders
- Fundraisers
- Online Challenge Members
- Pit Team Member
- Programmers
- Team Coach
- Team Identity Developer(s)
- Team Scout(s)
- T-shirt Designer
- Videographer
- Web Designer
- Engineering Notebook Manager

Also have back-up roles defined to enhance continuity in the event of illness or schedule conflict. The larger a team gets, consider using the Online Challenges (explained on page 7) to add meaningful content to the team's roles and activities.

Develop a Team Identity

Many teams attend competitions wearing team shirts and bring giveaway items to share with their fellow competitors. Don't forget to bring information about your institution. Performing an outreach function for your institution helps build on campus and local community/industry support for your team.

Pit spaces at competitions are places where teams can hang banners, posters, and even documentation of their design and development processes. While none of these items are required, they often pay dividends for a team in its own community and school.

As your team grows over the year(s), consider building a team identity through a name (to go with your team number) and a shirt or uniform. Add other pieces when your team has the ability. 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.

Purchase, Store, and Manage Your VEX Equipment

VEXRobotics.com is the home for your VEX equipment needs. Please remember that robots can only be built with official VEX products. Please consult the game manual (Section 4 - The Robot) as well as Appendix E for rules about robot parts and equipment.

Once your VEX equipment is unpackaged for the first time, you will need to store and care for it.

Organizing your VEX materials and workspace will enhance your team's productivity. There are affordable storage solutions that include toolboxes, plastic containers, and storage bins with compartments for small parts that will allow your team to stay organized. Each situation is different. Knowing your space, storage needs, and set-up is paramount. Keep in mind how much of your equipment will need to be portable for competitions as you make storage decisions.

Assemble an Adequate Tool Kit

Other than your VEX robot kit and your team members, it's a great idea (but not mandatory) to have 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 are good to have as well. Always be sure that everyone wears safety glasses while working on the robot and during competition matches.

Brainstorm

After your team members learn about the VEX U game for the year, they will be very excited to start building a robot! However, we encourage your team to develop and use a brainstorming process before building so that a variety of approaches can be considered. If your team begins the building process too soon, an effective strategy and design idea may be missed.

There are literally hundreds of brainstorming processes/systems. One simple way to brainstorm is to have the team list all of its strategies and design 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 will still be able to be competitive. Later, your team can get to the list of "wants" and "wishes" as time allows. Remember, this is only one of many viable brainstorm processes a team can use. In order to maximize the brainstorming process, teams can use mind-mapping software such as FreeMind http://freemind.sourceforge.net/wiki/index.php/Main_Page. Investigate several brainstorming processes and choose one that meets the unique needs of your team. Consider using the available virtual tools to "play the game" before you build a robot.

If you have team members who have never built a robot before, it might be a good idea to have them review the VEX Robotics Curriculum http://www.roboticseducation.org/educational-resources/ This free online resource walks students through the entire robotic design process from initial brainstorming to competing at your first VEX U Competition.

Be sure to record your brainstorming process in your Engineering notebook.

Build Your Competition Robot

After adequate brainstorming and research, the time will come to actually build a competition robot. Here are a few last things that a team might want to consider before starting the process:

- **Follow All Game Rules** as outlined in the official game manual.
- **Ask Questions about Rules** in official game Q&A forum. Registration is free.
- **Ask Technical Questions** at vexforum.com. Some answers may already be there.
- **Robotics Experience Not Necessary**. A supportive community is ready to assist.

Access to a 3D printer is a major opportunity for VEX U teams as 3D printed parts are acceptable components (within the size constraints) that can be added to a robots construction.

Document the Engineering Design Process in the Engineering Notebook

Successful engineering requires effective and efficient communication and documentation. Documentation of the design process is a critical element in the lives of nearly every practicing engineer and scientist. Maintaining a notebook is mandatory in VEX U in order to be considered for the top judged awards in the program. We encourage having team members document the design process. This can be a great tool to aid decision-making and, over time, will depict the team's journey and development of ideas. The new Engineering Notebooks that each team will receive as part of their team registration provides teams with a tool to capture handwritten entries that outline the ongoing design cycle of idea/need identification, task(s) to complete, and assessment/evaluation through testing. This Engineering Notebook is also a great place for sketches, pictures, and calculations. Again, there are many documentation models out there, so investigate and use the one that fits your team. Examples of top notebooks may be found at: http://www.roboticseducation.org

One of the main missions of the VEX U Competition is to help students acquire real world life skills that will benefit them in their academic and professional future. The Engineering Notebook is used to document a VEX U team's experience as they prepare for the VEX U competition. This documentation should include the team's entire design process starting with analysis of the new game, brainstorming approaches to playing the game, and brainstorming possible robot functions. The team should continue to document their design analysis and their final building process including any iterations of the design they may go through over the season. Finally, the notebook should document the team's approach to project management.

Project management includes time management (how the team uses team members time), scheduling (what is the timeline the team sets out for the entire season), and resource management (how the team uses the financial resources, technical resources and expertise available to it).

The Engineering Notebook is required for the Design and Excellence Awards; each notebook should be created through a concerted effort by a team to document their design decisions. Throughout the season, many larger events will send their Design Award and Excellence Award winners to VEX Worlds. Teams should be aware that a design notebook is required to be considered for either the Design or Excellence Award at VEX Worlds. Teams should start their notebooks early and update them often. The use of engineering notebooks exposes teams to a variety of critical skills including project management, time management, brainstorming and teamwork.

Evaluate Robot Programming Options

In order to program your robot, choose a programming software package. See the competition manual for programming specifics. Software choices can be found at http://www.vexrobotics.com/vexedr/software.

If your team does not have a programming package, read the postings in the VEX Forums about the available software packages. Here are links to two different programming options.

intelitek	Carnegie Mellon University
easyC software www.intelitekdownloads.com/easyCV4	ROBOTC software www.robotc.net/download/cortex
easyC tutorial www.intelitekdownloads.com/tutorials/launch_cortex.html	ROBOTC tutorials www.education.rec.ri.cmu.edu/products/teaching_robotc_cortex

Test & Iterate

The great thing about the VEX Robotics Design System 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 behavior desired.

When testing new programming code, always save 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.

Getting Ready for Competition

After your team has completed the robot build and programming (following all game rules and guidelines carefully), and has practiced with the robot, it will be time to get ready for competition. It is common for teams to get nervous before the first ever competition but it is the most important learning experience 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.

1. Review the rules and run through the inspection checklist about a week before competition so there is ample time for adjustments.
2. Check the official VEX forums for rule updates and changes.
3. Visit the tournament's page on RobotEvents.com and read it carefully. Specifically, look for details about your team's pit area, available concession areas, electrical sources, and any venue-specific rules.
4. 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
    - 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
5. Be sure to read, "Things You Should Know Before Your First VEX Tournament" http://www.roboticseducation.org/documents/2013/06/101-things.pdf
6. Review the descriptions and criteria for the awards that are being given during the tournament.
7. Prepare to answer questions from the judges.

What to Expect at an Event

Please check RobotEvents.com for the specific schedule of the tournament your team is attending.

A typical one-day tournament will most likely have an agenda similar to the table at right.

Tournaments are busy, fast-moving days. Here are few tips for success:

- Make sure your team is well rested.
- Arrive a few minutes early, if possible.
- Drink plenty of water to stay hydrated.
- Review the agenda as soon as the team arrives onsite.
- Pay attention to the match schedule and arrive at queuing before your scheduled match.
- Don't forget to use the tournament as an opportunity to network with other teams and the friendly event personnel.

Example One Day Tournament Agenda	
7:30 a.m.	Doors Open, Practice Fields Open
8:00 a.m.	Concession Stand Opens
8:00 a.m. – 9:00 a.m.	Check-In/Inspection
9:15 a.m.	Drivers and Coaches Meeting
9:30 a.m.	Opening Ceremony
9:45 a.m. – 12:00 p.m.	Qualification Rounds
12:00 p.m. – 1:00 p.m.	Lunch (limited offerings)
12:00 p.m. – 1:00 p.m.	Robot Skill Challenge and Programming Skills Challenge
1:00 p.m. – 2:30 p.m.	Complete Qualification Rounds
2:45 p.m. – 3:15 p.m.	Alliance Selection
3:15 p.m. – 3:30 p.m.	Alliance Strategy Meeting
3:30 p.m. – 5:00 p.m.	Alliance Elimination matches
5:00 p.m.	Awards and Closing Ceremony

Additional Skills Opportunities for VEX U Teams

- Some VRC events will allow VEX U teams to run official skills scores. Browse VRC Events to find these opportunities.
- Skills Only events

Review Your Experience

After each competition, find a way to review the team's accomplishments. Whether you take home the Excellence Award or not, your team is always able to learn from its experiences. Consider inviting some of your sponsors, mentors, and community members to an after-tournament meeting. This would be a great opportunity to talk about what you learned and how you will prepare for the next competition.

Using Resources

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

1. Review information from VEX officials, community member on the VEX Forum www.vexforum.com.
2. Read about the VRC Competition awards by reading the Awards Appendix D found on the event documents page at: http://www.roboticseducation.org/competition-teams/vex-u/
3. Download the VEX Robotics app so that you can easily read and search the game manual.

Online Challenges: Get Everyone Involved

The VEX Robotics Online Challenges are another great component of the VEX U Competition. These challenges are free and provide additional opportunities for teams to become involved with the program. Additional information can be found at: http://challenges.robotevents.com/

Other General Tips

- It is best to do your programming work on a laptop you can take to competitions with you.
- Be sure to practice the game with the practice elements that are sent to your team in the Team Welcome Kit. Additional game elements can be purchased through www.vexrobotics.com.
- Safety comes first. Always wear safety glasses when working on your robot and while competing. It is also a good idea to have an adult present when power tools are being used.

Good Luck & Have Fun!