

# New Team Robotics Guide v2.0

## Intro:

When I started out in robotics, there was no good guide on what mistakes I should avoid doing and what things are really useful. Last year, I made a [new team guide](#). However, many of the links were now out of date, and I gained new information last season to make a better guide. This should be a helpful resource to new teams to help them avoid many of the mistakes that new teams make and help give them a better understanding of how vex robotics works. I hope that you find at least some of this information useful in your first season of robotics. This guide was written for the 2022-2023 season “Spin Up” but a lot of the information should be applicable to future years.

## Starting Out:

### Understanding the game:

The very first thing you should do to start off your season is watch the game reveal video. This video gives you a brief description of the game and shows you the basics. The 2022-2023 season’s game is [Spin Up](#). As I said before, the video is only a brief description, it does not include all of the rules for the game. The next thing you should do is read the [Game Manual](#). The manual is a large and imposing document, but don’t let it overwhelm you. It can easily be broken up into many manageable sections.

The first few pages aren’t too important as they are just the update changelog and table of contents. You don’t need the quick reference guide, and the changelog is unimportant as you will be reading the most up to date version. This is followed by the introduction which just explains the purpose behind vex robotics competition. Next is the primer which re-explains the game introduction. The note from the game design comity (or GDC) is important. In short, the game manual tells you everything you can’t do, not what you can do. There are many valid strategies and ideas not listed in the manual. The manual also has scheduled updates, you will want to set a reminder for the dates listed and check back at the changelog to see if anything big has changed in the rules.

Now, the manual moves into the field overview and definitions. The overview of the field should help give you a better view of how the field is set up and how it looks. The definitions define all of the terms for the game. The definition might be a bit confusing since you haven't read the manual yet, so you might want to refer back to this later.

The next section of the manual are the rules. There are 6 types of rules. First are < SC > rules, or scoring rules. These rules provide specific definitions of what is and isn't scored. This helps eliminate edge case scenarios at competitions.

Next, are safety rules or < S > rules. These rules just cover general safety and include things such as wearing safety glasses during a match < S3 >.

The next rules are general rules or < G > rules. These rules are mostly common sense and contain rules like don't destroy other robots < G12 >.

The next set of rules are the specific game rules or < SG > rules. They include rules about what you can and can't do in terms of gameplay such as where you must start the match < SG1 >.

The biggest set of rules are inspection rules or < R > rules. These state what can't be done on a robo and include rules such as no more than 8 motors < R18 >.

The final set of rules are the tournament rules or <T> rules. They explain how a tournament is run and include rules like you may appeal the head referee's decision after a match < T2 >.

The final section of the rules are the appendixes. Appendix A contains all of the specifications of the field. It will tell you the exact spacing for everything such as heights and positions of discs. Appendix B contains rules for the skills challenge. Another way to compete in a tournament. Appendix C contains the rule changes that affect college students.

## Making a team:

Now that you have read through the game manual, there is one more thing you should do before you start preparing to build your robot. You have to get a team. You should have a couple things in mind when forming a team.

First, make sure everyone is on the same level of commitment. If one person on your team wants to win Worlds and another doesn't care if you make it to state you will have issues. Make sure everyone wants to put in a similar amount of effort or at least understands that other teammates won't be as active in the robot design process.

Second, make sure you have the right number of people on a team. There is no limit to how many people can be on a vex team so you could be the only person on your team or have 20 other teammates. Personally, I would say that the ideal team size is 3 or 4 people. With 3 people you sometimes won't have enough people to do things and with 4 sometimes someone doesn't have a task to do. You will probably find yourself sitting around with no task to do if you have 5 or more people on your team. With 2 or less, it can be hard to stay on top of all the work you have to do.

## The Engineering Notebook:

### What is it?:

The engineering notebook is a bound notebook used to document the design process. It is not required to compete, but it is highly recommended. It can be a lot of work though, so if you have a smaller team, you could get away with not doing it your first year. You will almost certainly want to do one though if you are on a larger team. However, there are a lot of awards that you can win with it found on [Pages 15-19](#) of the judges guide. These awards can help qualify you for the regional event or even worlds!

### How to Build a Good Notebook:

The judges will judge your notebook based on the rubric on [Page 34](#) of the judges guide. Keep all of these things in mind when doing the notebook. If your team decides to do a notebook, do it well. I know so many teams that have written in the first 5 pages and given up. It would be a commitment if you decide to start.

A great way to start off the notebook is to give a brief overview of the game. Then give your initial thoughts on the game. Keep documenting the decision you make (such as what robot design you are using), and make sure that you explain why you made those decisions. As you

Always write in pen while doing the notebook. Keep it clean and neat. You may want to look at [Tips](#) from other people and look at [Other People's Notebooks](#). Oftentimes you may want an entire team member dedicated to the notebook.

## Building the Robot:

### Research:

Before you start building your robot or even decide what robot you want to try and build, you should do some research. When I built my first robot, I didn't really even know what I was building. Doing some research will help you come up with some ideas and provide guidance.

A great way to gain an idea of what you want to build is to look at the [Vex Hero Bots](#). These robots have great ideas for newer teams, and the robots come with step by step build instructions for robots that can be built with no experience. These robots won't win any tournaments, but they can give you ideas on how to build different mechanisms, or provide a starting base. These robots only use 4 out of 8 motors, so you can easily build the hero bot and then improve it with additional features.

You may want to also browse youtube or the vex forum to look at other robots. These robots will be more competitive than the hero bots, but they are also considerably more complex. Many of these robots have been built by teams that have been competing for many years. As a first year team, keep in mind that your team might not have the skills or time needed to build the robots you see. These robots can still show you useful ideas though, just don't be afraid to make a simpler design.

If your team is doing an engineering notebook, make sure to write about this step. You can list different reveals you watched, and your thoughts on these robots.

## Planning:

Before your team starts building, you should decide what your robot is going to be. Plan out what mechanisms your robot will have and where each of your 8 motors is used. Try and avoid making your robot more complicated than it needs to be by adding extra gear trains or sprockets. At the very least, your team should do a sketch of the planned design. This will also help make sure that everyone on your team is on the same page about what robot you are building.

If you are using a concept from another team's robot or Vex's hero bots, make sure you understand why the mechanism will help your robot score points. Also make sure you understand how to build the mechanism. Oftentimes it is better to start with a simpler robot. This will leave you more time for other things, and building the robot will always take longer than you think.

And again, if your team is doing a notebook, make sure to document the discussions in your notebook. You can write down your team's discussions, why you are choosing the design you are, and put any sketches in the notebook too.

## Building:

Now that your team knows what your robot is going to look like, it is time to start building. While it is a good idea to stick to your original design, don't be afraid to scrap an idea if you can't get it to work. If you have no experience building, you might want to check [this guide](#) out as a basic introduction.

Make sure your robot is stable, and [uses good building techniques](#). Some of the most basic tips are making sure you have shafts supported in two areas, and always use bearing flats wherever you have a shaft. When building, test your mechanisms whenever you finish them to make sure that they will probably interact with game objects.

The most important part of building is to make sure that you still follow all of the < R > rules. The easiest one to mess up on is < R5 >. This rule states that at the start of a match, your robot must fit within an 18 inch cube. If you are outside of this limit, you can't compete, so make sure that your robot fits, even if it means you won't be able to fit a mechanism you want on your robot.

## Finishing Your Robot:

The most valuable resource is time. Just because your robot is done, doesn't mean that you are ready to compete. At a minimum, you need to be done building your robot two weeks before the first tournament. You will probably want to be done three to four weeks before the tournament if you can though. Generally, you will gain so much more out of coding and practicing driving your robot than you will out of two more weeks of work. The exceptions are if your robot can't drive, you have to be able to drive.

You probably won't be able to finish your robot before your first competition starts to get close. This is fine. On your last week of building, make sure that your robot follows all < R > rules and can at least drive. Hopefully you can score as well as you want, but if it can't you will still be able to learn a lot at your first competition.

## Preparing for Your First Competition:

### Setting Up Your Code:

You have to code in order to compete. Otherwise, your robot would just sit there and do nothing. Vex has a lot of great resources on how to do this though so don't be intimidated. Here is a guide on how to get started with [block code](#).

Another way to code is using [vex code text](#). This will be more useful in the long term and it doesn't have some of the limitations that blocks have. However, if you don't have anyone in your club or organization without coding experience, and you want an easier job, you might want to go with blocks.

Your priority when coding, is to get to the point where your robot can drive and move any other motors you have added. The robot might be hard to control, so you might want to set your motors to a maximum velocity of 50% or even 25% when you are just getting started.

## Finding Roles on the Driveteam:

That the robot is built and coded, you need to figure out who will be driving during the matches. You can decide this however your team wants. You can do a drive off to see who is best, or have whoever is willing to practice the most drive. The most important thing is that whoever is your driver is consistent.

You are allowed 3 people in the driver station though and all of these roles are important. The other 2 teammates should be responsible for telling the driver where to go, keeping an eye on how much time is left, making sure you stay out of your alliance partner's way, placing match loads, and many other things.

## Coding an Autonomous:

Once you have your robot driving around, you want to make an autonomous code. This might seem like a daunting task, but you don't need to have anything very complex. You will be surprised when you go to your first competition that many teams don't have an auton. By just having something, you will give your team an advantage. An easy way to score points this year is to either spin the role or push your preload discs into the low goal. The most important thing is that you have something working.

Don't spend too long on your autonomous though, you will still want to leave a week for driving practice. Just get something basic working and then move onto driving.

## Practice Driving:

After your auton is done, you will want to practice driving. It can take a couple hours to get used to a robot, so make sure you leave time. There are a couple of ways I like to practice.

First, just get comfortable driving your robot around the field. Get to the point where you can drive from one side to the other and get used to driving it at max speed if you slowed it down to get started.

The next is by just driving around the field and scoring points. This is the least productive method, but it is really good when you are just starting out. I will score as many points for red then score as many points for blue back and forth.

The third way I practice driving is Skills. The skills challenge and setup can be found in appendix B of the game manual. Skills is good practice for matches and especially skills. It is generally a good idea for skills to work on a route or path and follow it everytime. Discovering the most effective skills path is a challenge in and of itself that your other teammate can be working on while you drive.

The final and most productive form of practice is scrimagges. If you have other teams at your organization, you can run matches with and against them. This is the best practice for matches, and it can also engage the teammates who aren't driving. It can be a good idea to record these matches so you can look back at them later and see and learn from mistakes you made.

## Final Prep for a Tournament:

Now that you are comfortable driving and have an auton, it is time to do some final prep. If you aren't hosting the tournament, you will want to bring some items with you. These include: the robot, 2 controllers, spare brain, spare, radio, spare smart cables, extra screws nuts and stuff, a set of tools, the engineering notebook (if you have one), spare batteries, a laptop with download cable, power cords, battery chargers, and a laptop charger.

This might seem like a lot of stuff, but I have needed everything on that list in the past. Things will break in robotics. You want to make sure that you have spares of all electronic components and you will need to make repairs too.

## Your First Competition:



## Before the Tournament:

Usually, tournaments start at 9:30, but the doors open at 8. You will usually want to show up at 8 and no later than 9. The first thing to do when you show up is get inspected. This is the process where your team will check in, turn your notebook, and the inspectors will make sure you are following all < R > rules.

Next, you will want to get power to your pit area. This will let you charge batteries and your laptop. Once you have power at your table, take your robot to the fields. Usually, the tournament will let you practice on the fields before 9. You will want to run all of your autonomous codes, and make sure they still work. Because it is a different field, the autonomous will probably run differently. You can change it with your laptop though if you need to.

Once your codes are working on the new field, you can relax till the drivers meeting. This is usually at 9:15. At the drivers meeting, the Event Partner (person running the tournament) will go through and explain how the day will be run. They will also go over any [Q and A Questions](#) retaining to how the game will be played.

## Qualification Matches:

After the drivers meeting, qualification match schedules will be handed out. You will be able to see what matches your team is participating in. Ignore the listed times though as events never run on schedule. Usually, each team will have 6 matches.

In qualification matches, teams are partnered with another random team and are up against 2 other random teams. The winners of the match will receive 2 win points and the losers will receive 0. In the event of a tie, both teams receive 1 wp. Teams can also get another win point by completing the autonomous win point task regardless of whether they win or lose.

Teams are ranked based on the average number of wp they have. In the event of a tie, the team with the most autonomous points ranks higher. If they still tie, then the team with the most strength points ranks higher. Strength

points are awarded based on how many points the losing alliance in a match earned, but they aren't really important.

## While Qualification Matches Are Happening:

In between qualification matches, there are a number of things you will want to do. First, you will want to talk with your alliance partner for your next qualification match. You can figure out what auton you will be running and what strategy you will use in a match. As a first year team, listen to your alliance partner as they probably know what they are doing.

Another thing you will want to do in between matches is run skills. Each team will be able to run 3 driver skills matches and 3 programming skills matches. I would highly recommend doing them.

You may also be interviewed by the judges. If you are, answer their questions as best as you can and you may earn a judged award. Even if you don't have an engineering notebook, you can still win a Judge's Award.

Watching matches and talking to other teams is also a good idea as that will help you with alliance selection.

## Lunch:

I would also recommend bringing your own lunch as that will be faster than getting it during the tournament. Most events give an hour for lunch, but there is more to lunch than eating. Over lunch, you will have the opportunity to run skills matches. The fields used for matches will usually be open up for practice matches. This is a great opportunity to figure out your auton if it isn't working. Lunch is the best time to also figure out who your alliance partner will be. If you have the time, you might even want to eat between your qualification matches so you can have more time for skills. DON't forget to eat though, you want to keep your energy up.

## Alliance selection:

The alliance selection system will form the alliances and tournament bracket for the elimination rounds. Qualification rankings are the only thing used for determining who gets to pick, but many other factors are usually used to determine who is picked.

The alliance selection begins with the team who ranks first in qualifications. They may ask any team to be their alliance partner. If the team who is chosen accepts, the number 1 seed is formed. If the team declines, the team who ranked first in qualifications may pick another team. A team may ask as many teams as they need to in order to get a partner, but teams can only deny another alliance once. If they deny an alliance, they will have to wait until they get a chance to pick.

After the number 1 alliance is chosen, the team who ranked 2nd in qualifications may pick their partner (unless the team who ranked 1st chose the team who ranked 2nd, then the team who ranked 3rd would get to choose). They can pick any team that is not already in an alliance and has not denied any team.

The process continues until all seeds are formed. At local events there are usually only 8 alliances so some teams might not make it into the elimination rounds.

## The Elimination Rounds:

The elimination rounds are played in a single elimination bracket. Elimination rounds are best of 1 except for the finals at worlds qualifying events (state). The higher seed alliance plays as red (unless there is an upset). There usually isn't a lot of time in between these matches, but you should spend it strategizing with your alliance partner. It can also help to watch the match of the alliance you will be up against if you win. This would mean, if you are the 1 alliance, you should watch the 4-5 match, because if you beat the 8 seed then you will play the winner of the 4-5 match.

After the elimination rounds, 2 teams are crowned tournament champions. Other awards are given out at this time too or before the finals. These include excellence, design, judges, and skills champion.

## After the Your First Competition:

### Reflection and Planning:

Your first practice after the tournament, you need to reflect. What did you learn? How did you do? Do you want to do better at the next tournament? Did you see any ideas on other robots you liked? Is there anything you can do to improve? What were some weak points of your team? These are all good questions to ask and great things to put in the engineering notebook.

Once you know what to change on your robot you should see when your next tournament is. If you only have a week, you aren't going to want to make many major changes. If you have 2 months, you could build a whole new robot.

Repeat this process after every tournament, and you should keep improving your robot all season long.

### Qualifying for State:

As the number of tournaments left draws to a close, you should think about trying to qualify for state. If you have already won an award, you can look up the event you won it at on [Robot Events](#) and see if it qualified you for your regional event championship (state). If a team double qualifies at an event (which usually happens), then the extra spots will be given off of the skills list at that event. If it didn't or you have won any awards, you can still qualify through skills.

You should look up your state event and see how many spots are open for it. Then, you can see what your team is ranked [State Wide](#) in skills. If you are ranked higher than the number of spots at state, you should make it in.

The reason behind this is that the top teams in a state will win multiple qualifying awards at multiple events throughout the season. This is called double qualifying. Because the same teams keep winning, state isn't full. To fill the extra spots, they will go down the state skills list and invite teams off of it until state is full. It is rare for a team who is beneath the skills cut off to win an award for state, but it does happen.

## Qualifying for Worlds:

The best way to qualify for Worlds is through the state event. As a first year team, it is highly unlikely you will be able to qualify. In order to qualify you will have to win an award that qualifies for Worlds. If a team double qualifies at state (which usually happens), then the extra spots will be given off of the skills list at state.

## Conclusion:

I hope you learned a lot from this guide. Feel free to refer back to this guide throughout the season as certain events approach. Some other great resources are [Vex KB](#) and the [Purdue wiki](#). Vex Robotics Competition (VRC) is a wonderful opportunity. You will learn so many skills, especially in your first year. I would highly recommend doing it all 4 years of high school as each year it is a different game and you will learn new skills every year.

Good luck this season.

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