

# Team Divisions

## A Foreword of Sorts

In it's purest form, FIRST isn't an organization about science, technology, math or engineering. It's not about the contest, or even Gracious Professionalism. In it's purest form, FIRST is about people. FIRST is the way to inspire students and adults, people of all ages to take interest in science and technology. FIRST inspires people go push themselves farther than they ever have before, if only to find out where the upper limits are. FIRST stands "For the Inspiration and Recognition of Science and Technology", but can stand on it's own as "FI". For Inspiration.

Though the 6 weeks of build and two months or so of competition come and go faster than you'd expect, they can be the best, worst, strangest and most memorable times of the year. Your team is a family, your friends and teachers, your adult mentors and youngest rookies. The people you laugh with, the people you cry with, and the people you cheer with. Your team is the people you'd go to war with (and have, in some aspects have.) Even as you go into life, as prepared as you can be, you cannot and will never forget them.

This manual is a feeble attempt to catalog the strange, explain the obscure, and to train the next generation of innovators and engineers. To practice what you preach to the extreme, and to hopefully help someone found, run, or maintain a team in any position thereof.

Thank you.

Tim Flynn - KD2KRT

Mentor (Apparently), Alumni, and FIRST Inspiree

---

## Crash Course in FIRST

---

### Overview

The FIRST Robotics Competition (FRC) is the largest of the four FIRST (For Inspiration and Recognition of Science and Technology) Programs, and one of two for high school students. Founded in 1989 by Dean Kamen and Professor Woodie Flowers (see History), it was originally a competitive robotics course for students at MIT. However, it soon grew into much more than a simple robotics program. After nearly 30 years, FRC has evolved from a simple robotics course at MIT to a worldwide robotics competition that involves thousands of high school teams and hundreds of thousands of high school students. These teams and students compete against each other every year in a game that FIRST designs with robots that they design and build themselves to complete the game's challenge.

Teams start building their robots on January 8th each year when the yearly game announcement ("kickoff") happens, and have only 6 weeks to design, build, and test their robot. With a \$500 part limit, and numerous constraints, they must build a robot to the best of their ability, and hone their skills as a team and individuals in not only the robotics categories, but also in gracious professionalism, business, communication, collaboration, and the many sub teams that so many teams have.

Each team may have multiple subteams, but some subteams that are shared by most teams include build, programming, design, marketing, drive, strategy, outreach, and wiring. Each subteam is essential to helping the team succeed, and while teams such as marketing and outreach are not directly involved with building or testing the robot, they are still essential by helping the team gain the money necessary to enter the competition and build the robot, as well as travel to competitions.

## **Regionals vs Districts**

At the end of a Build Season, teams, depending on their location, either compete in a District system or a Regional system. Regionals are larger events varying between 60 and 90 teams, often from a large area. Their venue is usually larger in scale, and can qualify them for World Championships right off the bat at their regional events.

In a District system, however, teams must compete at two District "events", usually comprising of approximately 60 teams and 90 matches to earn "District Points". Following the performance at their District events, they may qualify for a District Championship. At the end of a District Championship, qualifications for World Championships are handed out based on points, Hall of Fame, Rookie All-Star, Chairmans Award, and other factors.

## **History**

The FIRST organization was founded in 1989 by Dean Kamen, of DEKA Robotics and Prof. Woodie Flowers of MIT. Woodie had envisioned and designed a competitive student robotics course for his MIT 2.70 course (later evolving into 2.007), but wanted to make it appeal to not only *his* students. With the help of Dean Kamen, the inaugural game of "Maize Craze" was held in 1992, giving birth to US FIRST, later expanding into the FIRST family.

In 2005 the pilot program of the FIRST Tech Challenge, in cooperation with Innovation First Intl. (commonly known as VEX Robotics), was created. The program used the standard VEX kits and offered a lower cost alternative to getting involved in the FIRST ecosystem.

Over more time, two more programs for younger students were created, being the FIRST Lego League and the FIRST Lego League Jr. Together, they form a robotics family of programs capable of following a student from K-12.

## Who Are Mentors?

In the world of FRC, mentors are individuals who assist a team in some capacity. Sometimes mentors can be gained via sponsorships, via alumni, and from other sources. However, mentors are most commonly teachers and the parents of students who have some skills.

- Ex: Bob and Sally's Dad is a businessman and wants to help the team keep their business in order, as none of the other mentors have business experience.

Some types of mentorship are based on skills, while others are not. Programming mentors could help a team create a new vision system, or a parent mentor could just make sure that everyone gets to competition in order, taking the stress off of the other mentors. Often mentors rely on one another as much, if not more, than students rely on one another, as they already have much on their plates (being college students or adults with actual jobs.)

## Who Are Volunteers?

The volunteers are the people who keep the events, and FIRST to a lesser extent running. Without the hard work of the volunteers, being family members of teams (or entire teams), alumni, businesses with a vested interest in the programs, FRC as we know it could not exist. They run the field, the pits, the administration, and some of the most crucial parts of our community.

\* Ex: The Blue Alliance, a community site to view team information, was developed by students turned mentors, and is sponsored by Firebase and IFI.

---

## Everyone On The Team

---

- Contribute to the team as much as you can, even though it might be something small.
- Keep a cool head at all times.
- It doesn't hurt to help another team, **ever**. They love FRC just as much as you do!
- Sit down once a match begins / after your team is selected for an alliance.
- NEVER talk badly about another team. They know their own mistakes as well as your own team knows theirs.
- Read the RULES! You never know when you'll be doing someone else's job. A thorough knowledge of the rules is ESSENTIAL to many roles on the team - strategy, scouting, even design and build. You don't want to build something that is not competition legal, and scouts need to know if a team is breaking the rules.

- Mentors and captains are there to help **everyone** on your team, not just you. They're also really nice.
- Talk to other subteams, your visions may not align, or may be shared! Communication amongst team members is equally as important as comms between the DS & the ROBOT. *Collaborate!*
- Always be positive. Please don't talk negatively about yourself, a specific group of people, or the team in general. Attitude is everything.
- Don't be afraid to ask questions.
- MAKE FRIENDS. People are so nice.
- There is *always* something to do, you just have to ask.
- While many of us would love to dedicate all of our energy to the team (and some of us do), unfortunately, we still have other, very important priorities. DO NOT let robotics become your #1 priority. That GPA is more important.
  - Don't lose sight of your future goals and dreams. That being said, putting your entire heart and soul into the team can be a good thing. Just keep consequences in mind.
- Don't take disagreements on robot or team decisions personally. Everyone wants the best for the team, even though there may be disagreements as to what that is.

---

*Train the way you fight. Because you will fight the way you have been trained - Sun Tzu*

---

## Officers & Leadership

---

- **Lead by example**, not by order. You are not an exception to doing work.
- **Set clear goals and make sure you have a plan outlined.**
  - **Keep the goals simple, brief and achievable.**
- **Set a timeline and/or deadlines. Adhere to these.**
- **Delegate effectively, so you can get more done - other team members get experience and you can stay sane.**
- Remember:
  - People see you as role models, whether you want them to or not.
  - It's still just a **game**.

- Notes are important. All subteams taking notes makes recalling binned ideas that may help the team later is important.
- Account for mistakes, plan for them, but don't hold it over someone's head. It'll never help the team as a whole, and ruins the mood.
- The best plans are the ones that work and get the job done efficiently.
- Know who's who.
- A team that fights within itself can never defend against others. Solve internal struggles and the external ones slacken.
- No one needs to be able to do everything, though the officer team needs to be able to make sure everything gets done.
- Make good friends out of your teammates, and the dynamic that produces an amazing team is soon to follow.
- Reference: [Roles of Team Captain](#)

## Electronics

---

- Checklists are helpful.
  - **Never** skip a checklist if you use them, though you may add to one at an event.
- When a robot breaks down, it is usually an electronics problem, so make sure your robot works before going onto the field.
  - For example: RSL Brownout
- Make sure you turn your robot is turned on.
- ALWAYS connect to the field at least once before qualification matches start.
- One of the best things that you can own is a [Battery Beak](#)

## Build

---

- Strategy should happen before design and design should happen before fabrication.
  - Not that strategy can never be re-evaluated during design or design can be revised during fabrication
- Focus on having a working robot that achieves its strategy goals, not about its design.

- Determine whether you want a robot that specializes in one aspect of the game, or one that can be cheesecaked and can support the alliance.
- Bringing multiple battery chargers is a GOOD idea.
- Developing a new feature/mechanism for the robot during competition is almost impossible when focusing on match preparation.

## Programming

---

- Don't overcomplicate your code.
- Clean code is good, functional code is better.
- Changing the code during competitions is do-able, but risky, so try to avoid it. Keeping your code with you is also important, just in case you need to compile for a RIO spare.
  - Try to test it a practice field if possible
- Use WPILib & Screensteps if starting off, and ask your fellow programmers for help! [ScreenStepsLive](#) - [WPILib](#)
- Pick a programming language that works for your team. You don't have to work on the language other teams are using, but use what your team knows, and can support.

## Drive

---

- Make sure you know the game rules.
- The actions of the human player can greatly determine the outcome of a game.
  - Human players are generally responsible for moving game pieces. A skilled human player can help their alliance control game pieces to maximize scoring and sometimes reduce opponent scoring.
  - Drivers that might fight amongst themselves can have their attention split between the field and their fighting, resulting in mistakes being made.
- Communication between members of drive is *essential*. Don't be afraid to talk to one another!
- Teambuilding and culture of a drive team is *very* important. Try to have some fun when you're not stressing out over the game at hand.
  - For example, 1257's 2016 drive team would play [Super Meat Boy](#) to practice reaction timing and [Keep Talking and Nobody Explodes](#) to practice their communication skills. Though interruptive during meetings, effects were found to be clearly noticeable.

- Reference: [254's Guide](#)

## Strategy

---

### General

- Knowledge is power. Take every opportunity you can to make yourself more powerful.
- A good robot with great strategy almost always trumps a great robot with good strategy
- Scouting has two primary applications: formulating match strategy and planning for alliance selection.
- Scout at EVERY competition. You never know for sure going into a competition if you'll be an alliance captain. Even if you do not think you have a good enough robot to seed high, you may end up with a nice schedule. Even if you do not pick, the data can be used to formulate smart match strategy.
  - Don't let a lack of manpower be an excuse. If your team is short-staffed, reach out to other teams at the event to collaborate on scouting
- If you don't end up scouting for some reason, ask teams if they'd be willing to share their data with you. You would be surprised how many teams would be happy to help a team unexpectedly thrown into a captain spot.

### Pre-Scouting

- At a non-Week 1 event, you will often compete with teams who have already competed elsewhere during the season. Match video from these prior events may be used to *pre-scout* the teams that will be at your event.
- Pre-scouting can be used to train scouts and test the relevance and usability of scouting sheets or electronic scouting systems.
- Don't let pre-scouting be an excuse not to scout at the event. Pre-scouting data is *extra* data to supplement the more accurate, up-to-date information collected at the event.
- At District/World Championship events, or even late-season other events, it can save time to prepare a preliminary picklist based on pre-scouting data
  - Do not get too attached to any preliminary picklist.
  - Teams may improve with increased experience playing the game and even develop additional functionality at their later events (e.g. in 2016 when low-goal focused robots successfully implemented shooters mid-season, such as 610)

- Pre-scouting data can be used to identify when a robot had a strong showing at a previous event but encountered issues
  - These issues may be fixable, and you may be able to pick a strong robot other teams at the event may not know about
  - These teams may make especially good risk picks for a low alliance

## Scouting Itself

- Have one scout dedicated to each robot in the match, recording quantitative data and comments
  - You may also have a "super-scout" or two watching the match as a whole for higher level strategy, defense, driver skill, or anything else of note.
- Look for what good teams do...
  - Quantitatively? In other words, how much do they complete various scoring objectives?
  - Qualitatively? In other words, what is their robot good at and what is their strategy?
- Scouting is not just about how many points a team scored, but how that team performed and what sets them apart from other teams.
- Important qualitative factors to watch for:
  - Drive team skill.
  - CONSISTENCY
  - Recovery from driver mistakes and robot failures.
- When scouting, look for teams' strengths *and* weaknesses. Both can be used to best them
- Look for teams with the "X-factor", that powerful drive to go above and beyond to win. Some teams demonstrate it with their previous event results. Others demonstrate it in excellent match strategy or driver skill. Look for it, and while it shouldn't be valued over robot functionality, it can be used to determine the best pick among similar robots.
  - Example: 1257 at Mount Olive 2016, selecting 1676 in order to play defense. Their drivers demonstrated considerable skill during qualifications, and the team has a history of competitive success. There were a number of other robots who *could* have played skilled defense for the alliance, but 1676 went above and beyond and helped them win the event.



- Using electronic scouting is great, but if it seems beyond the team's reach, resort to just using paper scouting.
  - Just make sure you don't cut down a forest.
  - Paper is failsafe in a way electronic scouting isn't.
- Drive team depends on scouts for competition information, and especially for alliance selections.
- Good communication with the drive team is very important, scouting will be useless if the data is not put to good use.

## **Making A Picklist**

- There are three ways an alliance partner can contribute to an alliance:
  - Direct offense: Scoring points (2016 example: scoring goals)
  - Indirect offense: Enabling alliance partners to score points (2016 example: bringing boulders to the courtyard)
  - Defense: Depriving the opposing alliance of points. Most defense falls into one of two categories:
    - Obstruction defense: physically prevent scoring attempts, by either preventing access to scoring positions or causing shots made to miss, possibly with a wall.
    - Game piece defense: deny opponents access to game pieces or otherwise make it harder for them to obtain them. This can involve picking up game pieces and placing them in a protected zone from the opponent (the secret passageway in 2016) or by providing them for alliance partners to score, which is called feeding (which doubles to help offense).
  - Always have a contingency plan for defense played against you
- Before starting on a picklist, discuss strategies for playoffs.
  - What would the composition of your ideal alliance look like? Your options include:
    - 1 - Triple offense (2016 Carver Division, Alliance #2)
    - 2 - Two offense and one defense (2016 Tesla Division, Alliance #1)
    - 3 - Two offense and one feeder (2016 Hopper Division, Alliance #1)
    - 4 - Offense, a feeder, and defense (2016 Waterloo Regional, Alliance #2)

## 5 - Offense and two feeders/defense (2012 Newton Division, Alliance #2)

- Generally, your choice is between a, b, and c. Deciding between these three options requires examining which will contribute the most to the point margin between yourself and your alliance. Often, a defender can deny their opponents more points than an offense third pick will be able to score. Many times, two offense robots will be more efficient if one robot focuses on feeding game pieces to the other, who scores them, rather than having both robots acquire and score game pieces themselves.
- Option d may make sense if your captain/first pick pair consists of an exceptionally good feeder (fast robot with a fast intake) and an exceptionally high scorer, and the third robot would be able to play better defense than offense.
- Option e is generally unwise, if not downright illegal (as it was illegal to have two opposing robots in a courtyard in 2016). However, this does not mean it should never be considered. On rare occasions, one robot scoring game pieces *can* outscore an opposing alliance. In the example listed, the #2 alliance on Newton in 2012 employed this strategy because 1717, the captain, was an incredibly fast and accurate scorer. The alliance had the other two robots (469 and 2471) play on the opposite side of the field, acquiring game pieces and shooting them to other side of the field for 1717 to score.
- A good guiding question is "How many points would our weakest robot be able to score, and how does that compare to how many points they can take from our opponent?"
- What other strategies might your alliance have to face?
- What kind of robots will make this alliance a reality?
- What strategy will maximize your chances of winning?
- Choose a strategy, then \*design your alliance around your strategy. \*Have a plan to win and choose robots that will help you execute your plan.
- Identify the teams that maximize your chance of winning.
  - Don't simply pick the highest scoring team available, though that is often what maximizes your chance of winning
- If you have ANY chance of finishing in the top fifteen teams, MAKE A PICK LIST (or a few) THE NIGHT BEFORE ALLIANCE SELECTIONS. Have a ranked list of robots you want, or alternatively a separate list for each role you'd want robots for (e.g. shooters, defense, low goal, etc).
  - There should be at least as many teams listed as there will be teams in playoffs (CMP, 32 teams; elsewhere, 24). You should be willing to work with absolutely any of them.

- As additional matches are played after your list is assembled, move teams up and down as needed. Some teams shine on their second day. Others robots break. Keep scouting, and observe upward and downward trends. If robots are having issues, reach out to the teams and find out how fixable they are. A strong robot may be available later than they should be because other scouts were concerned with issues that you know can be resolved. On the other hand, a robot on the rise may be passed over due to their weaker previous showing.
- NEVER leave a robot off your pick list because they "won't be available by the time you pick". *You never know*

## Alliance Selection

- Do not just pick the highest ranked available team. Rankings can be deceptive, as teams may have had easy or difficult schedules. Qualification rank says nothing about what a team can actually do in a match
- If you have a good, well-reasoned picklist, you'll be fine for alliance selection. Do not worry about making the perfect pick, just pick the best one from your list.
- The scouting team should talk beforehand and make it clear how much the team representative is allowed to deviate from the prepared list. In the past, I have regretted going strictly by the list rather than by my gut. On the other hand, teammates may be annoyed by going against the mutually agreed-upon ordering.
- When picking alliances, rather than focusing on your picklist, try picking teams based on what other alliances pick, so you can beat them with the greatest advantage.
- When picking, keep in mind where you are picking from and who you will face.
  - Keep in mind how deep the field is and the difference in strength between the top picks, middle picks, and late picks. Where the field "drops off" can make or break alliances.
  - In general, if you are picking from a high captain spot (1,2,3), go for the best consistent robot for your alliance. A robot that fails can cost you quarterfinal or semifinal matches against considerably weaker alliances.
  - In general, if you are picking from a low captain spot (6, 7, 8), go for a somewhat consistent robot with a high ceiling. You will almost certainly be facing a stronger alliance in quarterfinals and semifinals. If you want to make it past those, you will need to upset. A consistent #8 alliance is great, though if they can't outscore #1, they simply won't make it past quarterfinals.
  - Before starting your picklist, ask how much risk is acceptable and what your goal is. If you want to win above all else, as is typically desired at regionals and the championship, making riskier picks can make it easier to

create a higher-scoring alliance, though also one that is more likely to fail. If you want to make it as far as safely possible, as is typically desired at district events and district championships due to the point system, be more risk-averse, as risky picks can cost precious district points if they fail early on.

- A whiteboard can be a valuable tool for communicating pick suggestions to the team representative.
- *A note on declines:*
  - As you most likely know, when a team declines an invitation during alliance selection, that team cannot accept any other team's invitation.
  - On a superficial level, being declined may seem embarrassing. However, in order to maximize your chances of success, you must embrace that *declines are part of the game of alliance selection*.
  - Declines are primarily motivated by one reason: a team is confident they will be able to select another robot that they deem a better fit for their alliance.
    - It may be that there is a robot that better fits the role they want
    - It may be that there are simply better robots available
  - A valuable tactic that should be in every alliance captain's toolbox is what is referred to as "scorching the earth". This can be employed when an alliance captain may be considered weaker than the alliance captains ranked below it. This alliance captain can invite other alliance captains to join their alliance *with the knowledge that they will likely decline to form their own alliance*. This is repeated as desired, and if no captains accept, a team from outside the top eight teams is invited, who has to accept in order to play in playoffs. This renders these captains unable to be picked, splitting up strong teams and weakening the other alliances.
  - The most well-known example of the scorched-earth tactic is the 2013 Curie Division alliance selection. The #1 seed, 1678, invited the #6 (1717), #4 (2056), #5 (1310), and #7 (359) seeds who *all decline*. 1678 then invited the #16 seed (148), who was forced to accept. As a result, there was *no* inter-picking within the top eight teams. None of the teams who declined 1678 advanced past quarterfinals except 2056, who 1678 defeated in semifinals. While 1678 was able to win the division and advance to Einstein, they did not win in an especially dominant fashion, going to three matches in both semifinals and finals.
  - There is one important catch to scorching the earth: *any team you invite may accept your invitation*. Be ready to work with any team you invite! Do not shoot yourself in the foot by inviting a team you do not want to work with purely to separate them from other teams.

# Business

---

## Starting Off

The most important thing your team can do for business is to keep accurate notes to begin with. Knowing how much you have, where it's going, and who is helping your team financially or otherwise is *very* important. However, to keep looking as your expenses increase is not only the way businesses work, but also standard practice amongst the larger FRC teams.

## Notekeeping Philosophies

First and foremost, paper isn't a bad way to keep track of things to begin with. Though digital has it's advantages, companies you may reach out to often have digital letters and emails fall on deaf ears. Being aware of this going in can help you incredibly.

Notes can be kept on network shares, Google Drive, Dropbox, anything really. As long as your business team can see all of your documents to make informed decisions, it works.

Having a hierarchy of business folk can also be helpful. For example, having one student write a sponsor note / application and another proofread and approve it can very frequently find mistakes the first student had become blind to. Rinse and repeat the process as needed, as more and more smaller, but important mistakes can crop up.

Keeping track of your sponsors and keeping in contact is incredibly important. Some teams just use Excel / Google Sheets to keep track, and that should work for the majority of teams. However, tracking things like *individual contact info*, your previous years being sponsored by them, and anything and everything about the company's history in one place can help.

## Budgeting

Knowing the amount of money your team will need for a season allows you as an organization to set goals as to how much they'll need, and in what rate. For example, a Veteran Mid-Atlantic Robotics team will spend \$5,000 on district registration for two events, and \$4,000 on District Championship. Knowing this in advance allows your team to have fundraisers, bake sales, demos, and other financially beneficial events knowing well how much more you need.

## Fundrasiers

Should your team have the advantage of a surplus of students willing to help the team, but are unable to financially, fundraisers may be a way to bring in some money to help offset costs. Some ideas for fundraisers include:

- Gaming Tournaments
  - Smash

- Quake
- Halo
- Pasta Dinners / Socials
- Ice Cream Socials
- Car Washes
- Robot Demos with Tip Jars

As for recurring events, simply selling food after school / in town might be the way to go. Though it'd be low income, it'd usually be reliable and repetitive income.

However, be aware that all of these come with various coordination efforts that would be needed, and were you to host said events at a school district, you would also need to follow their policies. Proceed with caution on fundraisers.

## **Getting Sponsors**

As described in Notekeeping Philosophies, getting in contact with sponsors can be a difficult thing to do. eMails and phone calls often fall on deaf ears and empty inboxes. For smaller companies, simply walking in the door and asking to show them / give them a synopsis of what your team does, and how they might be the right group or organization to help yours can make a world of difference. For larger companies, however, having a foot in the door can help incredibly. For this reason, finding companies that your student's families work for can get an application submitted where their site may say "We're Not Accepting". \* Eg: A student comes in and says that their aunt works for Robot Co Building Company, the largest supplier of parts in your state. You reach out to her through the student, and have your proposal put before their corporate philanthropy department. They say they'll help you, and even match the family member's donations.

Local businesses may be more willing to help you, especially if relevant or helpful. For example, if a local Makerspace already spreads STEM and needs to promote youth involvement, FRC is an almost perfect fit for them. In addition, food outlets may help your team out for fundraisers as part of charitable work. HOWEVER, be aware that they still have to make money and may not be able to give you food or materials for free, but rather at their cost of raw materials.

## **Keeping Sponsors**

The most important thing you can do to keep sponsors is to inform them of what you do. Some ways to do this might be: \* Invite them to events. \* Send out a bi-weekly email blast with your stats and scores. \* Follow them on social media with team accounts and send stuff to them detailing your adventures as an FRC team.

The more effectively you keep yourselves in that organization's mind as a forward-thinking and good cause of their funds, you can potentially keep a sponsorship for

years. You may even be able to continue a "foot in the door" sponsorship that was started via a family member of a student, long after they have graduated.

Another very important factor in keeping sponsors is fulfilling your contractual obligations. Often when teams receive sponsors, they promise the company x benefits. A robot demonstration, them on the team website & shirt, etc. Making sure your team fulfills these requirements keeps your team in a good light, and also makes them more likely to keep the team as one of the organizations they support.

Finally, treating your sponsors properly, as organizations that support you, and not as "banks with hands" is an incredibly important but often overlooked thing. They chose to support your team, and didn't *have* to. In addition, sponsors may be supporting you with materials in kind instead of money, or with skilled mentors. This is *not* a valueless exchange, and you shouldn't treat it as such.

## Business Planning

- If you don't have a business plan, make one. It's not only a step closer to Entrepreneurship and Chairman's, but also a philosophy to keep the team running. It makes money easier to get, and sponsors more likely to stick around because of proven track record of responsibility fiscally.
  - [Writing A Business Plan](#)
  - Business plans shouldn't just cover the financial details of the team, they should be a guiding document for all team operations and organization.

## Nonprofit Status

If your team is attempting to pursue grants or finances, a significant amount of them are bound to *only* 501(c)3 type nonprofits. Though *FIRST* is a registered nonprofit, your *team* is not until you register much in the same way as some other teams have with the IRS (or relevant international equivalent). some example teams who have nonprofits, or use nonprofits for passthrough donations to the team include:

- 1257
- 303
- 1923 (in a sense)

Doing so requires people to run the nonprofit, being adults, and understanding the complexity thereof. Should your team be attempting to become a nonprofit, it is *highly* recommended that you do some research and ask for help with other local teams that have gone through the process. That way you're not likely to make the same mistakes.

Benefits:

- More Donations
- Tax Exemption

- Certain Technology Perks (Slack is cheap / free for example.)

Downsides:

- Adults needed to run it.
- More regulatory requirements.
- Need financial backing and tax advice at times.

## Safety

---

One of the most important things a FRC team can do is be safe, both on and off the field. However, "Safety Captain" is often seen as a useless job, as is it a thankless one. However, there are some things you may want to do to boost safety on your team, both over time, and immediately.

Make sure people recognize that and not take it as a joke. The safety of the students on the team is one of, if not *the* most important things a team needs to strive for. You can't put a robot on the field if your build team is in the hospital because of accidents.

Due to the incredibly-specific nature of *FIRST* Robotics Safety, this section will focus on a set of suggestions as to what makes a team safe, as well as what may be considered a "Road" to the Safety Award.

### Getting Started

The most important thing you can do is to strive for improvement, to have better safety than not only year's past, but also previous events and days. For example, if some of your team members forgot safety goggles at an event, make *sure* they have them before leaving for the next event.

Some other things that may help educate and quickly bring people up to speed (allowing you to move faster on the more serious training) may include:

- Powerpoint on existing tools.
- Safety quiz to prove knowledge learned.
- Training with mentor or older members of team to use said tools.
- Make safety contracts and rules and make sure both the parent and the student signs it.
  - Please note that this type of semi-drastic action often requires the approval of your head mentor (and usually school district.) Check with them before implementing such a system.

### Improvement



As you approach the point where you consider your team to be decently safe, consider where things may fall through the cracks and work to patch those. (Eg: What if you as Safety Captain aren't there for an event.)

In addition, Safety Captains have a significant amount of responsibility, dealing with the safety of *everyone* on the team. In theory, a Safety Captain could tell their President or Driver they can't go on the field (likely a safety inspector would catch them first though.)

Some middle-of-the-road difficulty things you may wish to approach might be:

- *It may not seem like it, but you hold a lot of responsibility for the members and mentors of the team.*
  - Their safety may/may not fall back on you in some circumstances.
- Don't teach safety via shock, fear, and intimidation will seldom work. *Do not make them fear the tools they need to use.*
  - Teaching and making sure they understand what they're doing and what they put themselves at risks for is key.
- Get to know every person, even if their subteam is not directly related to robot safety.
  - Some people hide their injuries without telling the Safety Captain. Make sure that they won't hide it, for both their personal health and safety, and for the image of the team.
- Make your own team Safety Rulebook, specific with your school's rules and regulations (if you are part of a school)
- Teach members responsibility by having the team purchase new safety glasses for each new member (you will have to discuss this with your mentor/advisor) and telling them that the team will not buy new pairs if they are damaged or lost.
  - If the safety glasses do not have a side and upper (distance covering space from eyes to glasses) guard, they are NOT safety glasses.
  - Prescription glasses used in daily life are NOT safety glasses.

## **Event Safety**

The most important item you can have at an event other than your robot are your safety goggles. Without them, you can't enter the pits, the field, or travel in certain parts of the event. At World Championships in fact, Google paid for *all* visitors to have safety goggles so they could safely tour the pits.

- Make sure to make clear distinctions between safety at school vs. at the arena
  - 2 different areas, more things to watch out for and rules to follow

- When competition comes around, make something that sums up your safety program and hand it out to other safety captains while getting to know their team program
  - They could have something in their program you don't have that could be a good idea to implement
  - Also helps to give it to safety judges when they come around

Having 2 Safety Co-Captains can be incredibly helpful, that way both people can rotate being in the pits during competition and one person won't be dead tired. The way that 1257 implemented it in years past was to have one in the pits, one in the stands to make sure everything is good in both settings.

- Have 2 first aid kits, one in the pits and one in the stands with a Safety Co-Captain or person who would always be in the stands.

### **Things You Might Help With**

As most of the time of a Safety Captain is spent in the pits, you may be able to integrate safety successfully into their procedure. Some suggestions might be:

- Help out with the robots pre-match checklist.
  - Make one if you don't have one.
- Make a checklist of things to bring to competition.
- Make a binder for all types of documentation.
  - Have the *FIRST* Robotics Competition Safety Manual.
  - Sort out all types of documentation by year or by type of document.
    - E.g. - Injury reports or Safety contracts
- Bring a metal trash can to competition.
  - Though this may seem strange, a steel trash can could be used as both a regular old trash bin, a container for a battery fire, or even just storage. The object is multifaceted and may save both people and expensive materials (in case of charger & battery fire.)
- Before every competition, discuss an emergency plan with mentors and students and teach a place to meet in case of emergency.
- Get a CPR / First Aid Certification.
  - Not only is it an incredibly useful thing to be (just in case), but it also looks good to Judges and other officials.

- Have machinery checks of the machines used the most (ask the head of your Build subteam about this) to check for damages and possible failures of safety subsystems. (Eg: ESTOP.)
  - Do this especially during build season (it would be horrible to use a broken machine unexpectedly and get hurt)

## Design

---

### Unification of Brand

A team's icon is the way they can stay memorable in their competitor's eyes in addition to the judge's for the Imagery Award. However, it's not just awards that are important. How you, your team, and your workspace / pit look can vastly effect how another team views you.

The most basic thing to begin with is a style guide, for all matters official. Any letters to go out, standardize the font and color and appeal. For team uniform, standardize on shirts (whether they be t-shirts or polos), and pants / dresses. However, you should never let design interrupt safety.

Some things to include in your style guide may include:

- Team's Colors
- Team's Logo (ALL versions)
  - Sponsor's Logo Guidelines (if they have any)
- Pit Design
- Pit Layout
- Banners
- Signs

Regardless of how you or your team decide to go in terms of vision, the most important thing you can do is have consistency. A good document on the subject is by 1538, The Holy Cows. [Read Here](#)

### Document Style Guides

Though traditionally, documents are typically the work of a business or business-like subteam, the way they appear can be a crucial role in how your sponsors view you. Standardize on a team font, one that's *readable*, that you'll use for all of your letters leaving. Another thing to consider would be team letterhead and footing. Many businesses have official stationery for official business, and having such can only improve your reputation as an organization.

### Outreach

Outreach in *FIRST*, and more specifically, in FRC, is the act of demonstrating either your robot, or the goodwill of a team to your community. It can range in anything from demoing robots at a science fair for the FLL kids, to volunteering at a food bank to support your town. A fantastic example of outreach as of late would be the [1418 Lego Robotics Camp](#), where they gave kids the opportunity to run that year's FLL game, as well as the chance to drive 1418's 2016 robot.

First and foremost, outreach is something that all teams don't have to do. However, it is helpful to get new members and go for awards like Rookie All Star and Chairman's. It may not be *feasible* for a lot of teams to do outreach on a large scale, however. Knowing where your team lies to begin with is an important line to know of. The most important thing your team will need for outreach, more than anything else is *people*. Having people who understand what your goal is, to coherently and publicly speak about and for your team is something you may not have, and conversely may desperately need.

Getting outreach coordinated is a complicated thing, and often requires the head of a [leader](#). Being able to coherently and efficiently speak about the team reflects better on both you as an individual, and you collectively as a team. As a result, you may gain (business)[#business] contacts, and potential sponsors, as well as prospective new recruits for your team.

## **Small Scale**

Outreach on a small scale can be something as simple as just demoing your robot. With one or two people, you can exhibit your robot in a high-traffic area and show off the robot, pique interest in both STEM *and* your team, and potentially raise some additional funds via a tip jar.

Some idea locations may include:

- Shopping Center
- STEM Fair / Science Fair
- School Lunches
- Town Meetings (via request to your town, of course.)
- Other Local Events

Example team size: 2 - 25 Members, 1-2 Mentors

One thing to note is, having business cards and media to distribute may accidentally gain your team a sponsorship. Local business owners out and about may see a group of individuals who know what they're doing, and may be interested in supporting "local students".

## **Medium Scale**

Outreach on the medium scale can be a rather complicated thing, often requiring a significant amount of prior planning. You can easily raise awareness, also likely helping your team when reaching for the "Model Team" category of awards.

Some examples may include:

- Volunteering as a Team
- Hosting a FLL / FLL Jr. event.
- STEM / Science / Summer Camp of some sort.

Example team size: 26-80 Members, 2-8 Mentors

## Large Scale

Few teams exist on this scale, and if they do exist, they have vast amounts of manpower. They can realistically perform any task they set their minds (and computers) to.

Some examples include:

- Hosting an Onseason Event ([303](#))
- Hosting an Offseason Event ([1923](#))
- Founding new FRC teams elsewhere.
- Founding and hosting FTC teams.

Example team size: 80+ Members, 8+ Mentors

## Mentors

---

First and foremost, the job of a mentor is to *guide* the students. If you are attempting to help your students, understand there is a certain way that many team mentors approach it. The job of a mentor is to guide a student or team to the choices before them, but not to influence them unless needed. Much in the way you can lead a kid to a library but can't force them to read, the same principle applies. The only reasonable time a mentor should intervene in the course of student events is if the choice about to be made isn't recoverable.

On that point, however, a mentor is also a source of inspiration. You have the vastly enormous responsibility to inspire and show your students what they're capable of and what *they* might one day be capable of. The weight of your actions cannot be understated. Try your best to be a role model at all times and on all fronts, but understand that you can't do *everything*. A failure of the team is not a failure in your ability, but a chance to do better moving forward.

---

It is possible to commit no mistakes and still lose. That is not a weakness; that is life. - Jean-Luc Picard

---

- There's no such thing as a bad idea, consider everything.
- Planning and note-taking can save you, write stuff down!
- Not all mentors are GP, you must be in the face of all adversary.
- Maintaining a flow of information from year to year is useful.
  - Writing down everything the team did well, and how they did it at the end of each season might help.
- You are a student as well, learning the ins and outs of the *FIRST* Robotics Competition.
- Every opportunity is a learning one. Never pass it up.
- Volunteering gives you a chance to not only understanding both sides of the Competition Coin, but also to respect those who do it, and appreciate what they do in the "muscles I didn't know exist hurt" sort of way.
  - Shoutout to the Field Reset Crew (the recursive FRC!)
- Your actions reflect those of your students in both directions. You reflect them and they reflect you. Start off on the right foot and follow any philosophy you preach. "Do as I say, not as I do" seldom works in this competitive environment.
- Try to break up your responsibilities, that way if the team gains another mentor with specialization, it helps you more.
- All subteams are not created equal in the eyes of your students. Be aware of this and *never* treat working on a specific subteam (especially scouting) like a chore. If anything, you can increase burnout and lose students quickly.
  - [This thread](#) is a HIGHLY recommended read.

---

*Winning a match is not something a robot does, winning is a team effort that requires the cooperation of dozens of individuals. - [Andrew Schreiber on Chief Delphi](#)*

---

## Competition Notes

No matter the type, scale, or location of event, follow the rules of it to the letter. Reading the Administration Manual may help, but is rather heavy... Generally, don't do anything that could be in any way be construed as cheating / not being GP. No Wi-Fi access points / hotspots, no being rude to other teams, team mates, drivers, etc. Respect others pit areas, and above all else, remember that everyone else there loves

the competition just as much as you. Don't treat them with any less respect than they deserve for it.

- Regular District Events

- Bring snacks, prices vary per venue.
  - Some venues prohibit outside food and drinks. Some do search bags to enforce this rule.
- A schedule helps a LOT.
- Follow said schedule.
- The drive team knows when you're not cheering, the arena mood changes. Help them help everyone! **CHEER!**
- Spirit is important, not for the trophy, but for your morale. Fake it 'till you make it!
  - Spirit makes competition more fun.
- If there are audience selections are important, especially if your team is playing
- If you don't know, *\*ASK!* \*People like sharing what they know, especially in FIRST.
- Every team is a potential ally, even if they're against you in the next match.

*If you're having problems, don't be afraid to ask for help. Other teams *\*will* help you out of the kindness of their heart, it's just part of the culture!*

- Get used to songs on loop, it happens more than anyone is comfortable with...
- Get to know the event flow before hand, if at all possible. Ask another teammate who's been there before.
  - Know who's who.
- If a "bad" call is made, don't try and force a ref to see footage you took with your phone or anything. They do **NOT** look at footage, and cannot. Don't force them into an awkward situation.
- It is highly encouraged to talk to people from other teams.
- Remember, everyone is stressed at these events.
- If, at any point, you feel lightheaded, take a walk somewhere where there aren't many people.

- District Championship (DCMP)
  - See Regular Events
  - High-Stress  $\Rightarrow$  Don't forget to eat!
  - Do not expect to perform the same at District Events as well, teams have their own strengths and weaknesses.
  - Be aware: Judges may judge differently here, a bit more strict on rules compared to other events.
  - Get to know the event flow before hand, if at all possible. Ask another teammate who's been there before.
- World Championship (FRC CMP)
  - As high stress as it gets, be prepared. High-strung people *everywhere*.
  - Pack EVERYTHING you *need*, not everything you *want*.
  - Bring your own amenities (shampoo, toothpaste).
  - Eating on time will be difficult, but you NEED to.
  - Expect not to sleep as well as you would in your own bed.
  - The entire event is totally different from any event you've ever been to.
    - Different refereeing: The rules may be interpreted differently field to field.
    - Layout is a LONG walk (St. Louis) (~1 mile stands  $\Rightarrow$  pit, Archimedes 2016)
    - Food is EXPENSIVE. (St. Louis  $\Rightarrow$  Go to Culinaria up the street. ~4 blocks)
    - Merch can be had AT the event, bring spare change.
      - A event shirt can be anywhere between 20 and 100 dollars.
    - Event Handbooks are INCREDIBLY useful for not just people attending to see robots, but for teams.
      - They have pit assignments in the guidebook.
      - They're free, and usually near entrances. Get two copies, for when you lose one / give it to a mentor to have / look at.
  - The pit pathway is long. Multiple carts are useful (eg robot & spares)



- Mentors:
  - Get the hotel rooms as **FAR IN ADVANCE AS POSSIBLE**.
    - They only go up in price.
    - Same for plane tickets.
  - Do your own bag check (if by plane) the day before, so that you can get through lines quickly at the airport.
  - Logistics will eat up most of your time between your DCMP and your CMP. Plan accordingly.
  - If you are doing well in district play, start looking at logistics long before DCMP.
- Offseasons
  - Very different culture, much calmer & more relaxed.
  - Lower overall costs (500 versus 5k)
  - Often used to train backup / upcoming drive teams.
  - Sometimes have silly rules (human robot matches, robot vs humans, etc.)
  - A good way to get someone into FRC for the next season.
  - Occasionally has pre-rookie teams (registering for the next season next year)
  - Occasionally just as stressful as a regular event (see "Indiana Robotics Invitational")

---

\*While Grace will carry you through good times and victory, Professionalism will carry you through hard times and defeat. - \*[Venkatesh on Chief Delphi](#)

---

## Good Resources

### Karthik's Lectures

---

Karthik is a successful lecturer, former mentor of team 1114 Simbotics, and the head of the VEX Game Design Committee. He's lectured year after year at Championships in St. Louis talking about the various successful components of an FRC team. He covers everything from game analysis to scouting and strategy (including alliance

selection). His work with Simbotics is often considered the pinnacle of FRC achievement and tact.

- The Subtle Secret To Success TEDxUTSC
  - <https://www.youtube.com/watch?v=MfC3JdkEVgQ>
- Effective FIRST Strategies 2016
  - <https://www.youtube.com/watch?v=sJOfH-lomEQ>
- Effective FIRST Strategies 2013
  - [https://www.youtube.com/watch?v=Apk\\_X-maRf8](https://www.youtube.com/watch?v=Apk_X-maRf8)

Watching at least the first two are highly recommended, and are applicable not only in FRC / FIRST, but in anything you do. Overall, the general message is simple. When you are passionate about something, it becomes easy to not only meet expectation, but to exceed it. However, please note that a general summary to Karthik's lectures does in NO way do them justice, and viewing them yourself would be a great benefit to you.

## Gracious Professionalism / Coopertition

---

<http://www.firstinspires.org/about/vision-and-mission>

*"Gracious Professionalism is part of the ethos of FIRST. It's a way of doing things that encourages high-quality work, emphasizes the value of others, and respects individuals and the community.*

*With Gracious Professionalism, fierce competition and mutual gain are not separate notions. Gracious professionals learn and compete like crazy, but treat one another with respect and kindness in the process. They avoid treating anyone like losers. No chest thumping tough talk, but no sticky-sweet platitudes either. Knowledge, competition, and empathy are comfortably blended.*

*In the long run, Gracious Professionalism is part of pursuing a meaningful life. One can add to society and enjoy the satisfaction of knowing one has acted with integrity and sensitivity."*

### Coopertition®

*Coopertition® produces innovation. At FIRST, Coopertition is displaying unqualified kindness and respect in the face of fierce competition. Coopertition is founded on the concept and a philosophy that teams can and should help and cooperate with each other even as they compete.\**

*Coopertition involves learning from teammates. It is teaching teammates. It is learning from Mentors. And it is managing and being managed. Coopertition means competing always, but assisting and enabling others when you can."*

Gracious Professionalism and Coopertition may seem like buzzwords, but they are and become to each participant the spirit of competition. To read the words on a piece of paper, or in the many manuals of competition is one thing, but to experience them is an entirely different thing. People acting so selflessly, to forward not their personal agendas, but the values that they aim to extend to everyone they know, is inspiring. One such example is that of a soccer goalie, unable to tie his shoes. A player from the opposing team walked over and tied them for him, enabling the opponents to get a free kick. The opposing team, however, threw the free kick, allowing the game to continue on as normal. Without Gracious Professionalism and Coopertition, there would be no FIRST in the form we know it today.

## Jack Kamen & Imagery Award

---

Jack Kamen was the father of Dean, founder of FIRST. He was a comic book illustrator who supported Dean in everything he did, perhaps helping him do things he never would have otherwise. He was to Dean, what Dean Kamen is to the FIRST Family of teams and districts, inspirational and right in everything he did. The logo of FIRST and all FIRST events was designed by him, and in 2011, the FRC GDC honored him with a game, Logo-Motion. In addition, his long-lasting mark is the Imagery Award, presented at each event, in his honor.

\* "In honor of Jack Kamen, Dean's father, for his dedication to art and illustration and his devotion to FIRST. This award celebrates attractiveness in engineering and outstanding visual aesthetic integration of machine and team appearance."\*

<http://www.firstinspires.org/robotics/frc/awards>

---

## Indispensable Tools & Techniques

Certain tools throughout a build season are both essential and easy to lose. A quick list use useful ones:

- Screwdriver Set (two of them, especially for when you have two robot-related subteams)
- Wrench Set (metric & US, though you really should only use one when building a robot.)
  - Standardizing on all of your fasteners can greatly accelerate your workflow, as well as easily tell other teams what you do / don't have should they need to borrow something.
  - Mark your most commonly use wrench off with tape to speed up pit repairs.
  - For example, the 7/16ths wrenches on 1257 were covered with red tape to be found easily. We have / had about half a dozen of them.

- Wire Cutters
    - A good sharp pair is essential for trimming zip-ties, wires, and a whole load of other things. If you have a dull pair of cutters, it can stop the whole rhythm of the robot checklist in the pit, which is not a nice thing to have when you may or may not have
    - Many posts on Chief Delphi recommend this pair: <https://www.sparkfun.com/products/11952>
  - Multitool
    - Especially useful if you packed up a crate and need to open it *with your tools in the crate*.
  - Good Wire Strippers
    - <http://amzn.com/B00BC39YFQ>
- 

## Chairman's Award

---

- The Chairman's award is awarded to a team that best exemplifies the goals and mission of *FIRST*. It shouldn't be something you go for because it sounds prestigious, but rather something a team should work for if a majority of their actions both on and off season reflect the *FIRST* mission. Few teams have ever one, and even fewer have won it multiple times. What exactly a Chairman's team *is* is highly debated, as well as the secret sauce of the competition to an extent. Not what a team should be, being gracious, professional, and one who shares their love of Science, Technology, Engineering and Mathematics with *all*, but rather *how* you get there.

In short, Chairman's is about the journey to *and* the destination, rather than *just* the destination that all teams know.

[Chairman's Resources](#)

## Keys To a Successful Drive Team (254 and Travis Covington)

---

<https://frcdesigns.com/2016/01/08/keys-to-a-successful-drive-team-an-interview-with-travis-covington/>

Excerpts:

- "What do tryouts for drivers look like on 254?"

TC: We try to bring up new drivers early and retain them for as long as possible. We feel that the driver can be one of the most important roles on the team, and requires

some skills that need to be taught and that can be honed with time/practice. The more experience once trained initially, the better. Many of our best drivers started as Freshman/Sophomores and drove for 3+ years."

- *"What factors into your decisions on drivers?"*

TC: Many things, least of which is actual skill driving the robot. We have a large list of criteria which we send to the whole team prior to tryouts or selection. It is a prioritized list, from most important qualities to least important. At the top of the list is Maturity. The "Driver Qualities" list is as follows: \*

- Mature
- Communicative
- Respectful [and] Cooperative
- Humble & Accommodating
- Dedicated & Hardworking
- Experienced
- Skilled & Assertive
- Knowledgeable in Mechanical, Electrical & Controls aspects of the robot
- As you can see, knowledge of the robot is not a huge concern. Many of the things above cannot be taught and are harder to find. We also have attendance and GPA requirements of our drivers. These bullet points are explained on our selection criteria document but are summarized here for simplicity."

## RobotPy - Anatomy of a Robot

---

- <http://robotpy.readthedocs.io/en/latest/guide/anatomy.html>
- Though the guide is designed for Python, a language that not many teams use, the ideas and principles behind it are very useful, and explain the philosophy very well. Includes code & examples.

## Apps & Programs

---

- [GitHub](#)
- [The Blue Alliance](#)
- [The Blue Alliance Mobile](#)
- [The Blue Alliance on GitHub](#)
- [FRC Spyder](#)

- [FRC Drive](#)
- [Slack](#)
- [Trello](#)
- [Basecamp](#)

## 6054: What We Learned

---

- <https://www.chiefdelphi.com/forums/showthread.php?p=1591100#post1591100>

1. Lessons Learned:
2. Ordering parts is hard. Getting a system in place at the school to decide you need a part, and get it sooner than 3 weeks requires some outside the box methods of procurement for a school district.
3. The Kitbot is really good. It was simple yet flexible enough to allow us to modify it. The time we saved was crucial to writing code, and practicing driving.
4. Having FRC teams to rely on is awesome. We were lucky enough to be part of the NEOFRA [Northeast Ohio FIRST Robotics Alliance], and going to kick off with those teams, and seeing their robots from previous years was awesome. New teams should definitely find nearby teams to work with.
5. The control system setup walkthrough needs special attention to detail. A slight omission on step 4 of 30 will have you banging your head against the wall for days trying to get it sorted out.
6. Metal shavings are very bad for electrical components.
7. The stress on the drive team is hard to simulate outside competition.
8. As a new team try to pick a few things to do well in the game. If you have time to add in new functionality after mastering that.... Nah, you won't have time.
9. Getting sponsors is difficult. The average manager at a car dealership isn't as excited about robotics as a high school student. You need to have a few kids that are able to sell your team, your vision, and FIRST in general.
10. It's really important to keep track of dates like when FIRSTchoice opens, and when registration is due, and all the things that are on deadlines.

11. Retired mentors make great mentors. They have more free time, and a lifetime of experience.

## ScreenStepsLive WPILib

---

ScreenStepsLive is an invaluable tool for programmers who need to work on the robot code. They have examples in C++, Java and MatLab, though the concepts of PID tuning (among other things) are uniform to FRC regardless of the programming language due to the inherent nature of the RoboRIO.

- <http://wpilib.screenstepslive.com/>

## QDriverStation

---

QDriverStation is an open-source implementation of the driver station that runs on Linux, Windows and macOS. Supports virtual joysticks, and quite a few driver-station protocols. Not allowed for official competition, but okay for demos & offseasons if they allow it.

[QDriverStation GitHub](#)

## Advice for Rookie You?

---

This was a thread started by one of 1257's rookies at the end of the 2016 season with the intention of finding out what other people would tell their rookie selves. A way to go back and see what they'd have done differently, and any advice they think that they as individuals would have needed. Applies to both mentors and students.

- <https://www.chiefdelphi.com/forums/showthread.php?threadid=148836>
- Courtesy of frcguy on Chief Delphi.

*"Although I am still technically a rookie, I'll answer anyways. My answers are more geared towards advice for new rookies, but I hope not just rookies can learn from some of the things I experienced. Here goes it!"*

- **Hard work and long nights pay off.**

After weeks and weeks of long nights, delays, and problems, you might start asking why you are even still involved. Just keep doing the best work you can. When you see the robot that you poured 6+ weeks of your life in to at your event, on the field, it is one of the best feelings in FIRST!

- **Try your best, no matter what.**

While times may be tough, especially your rookie season, stay strong and try your best. The knowledge and experience you will gain from FRC is worth it.

- **"Powerhouse" teams are some of the kindest and gracious people you will ever meet.**

While they may seem scary with their large looming pits and many students and mentors, don't be frightened! Much of what I know is gathered from conversations with members of 254, 1678, 971, etc. Don't be afraid to reach out to these people and talk to them at competitions. I guarantee that you will learn something new.

- **Don't be afraid to meet new people and build relationships.**

Similar to the above, always meet new people and talk with them. You will gain so much knowledge and wisdom from other people. Just from talking with people, I now can contact some of the most esteemed minds in FRC when I need help or have questions.

- **Take advantage of any opportunities you are given.**

Always take advantage of opportunities that are presented to you. For example, I got to experience so much and learn so many things my rookie year from taking advantage of opportunities like visiting other team's shops, going to Champs, and just talking to people at events.

- **Clean up as you go, don't leave a huge mess at the end of a build session.**

Many times this build season we would leave tools out after finishing a task and put off cleaning up scraps, putting away tools, etc. This then left a major cleanup at the end of a session, which no one wants to do at 9:30pm after a long school day. Something we learned was to have an ongoing clean-up. This allowed us to leave faster after sessions and everyone was in a better mood!

- **Get a printer and make mechanical drawings.**

As one of my colleagues said in another thread, without a printer our robot probably wouldn't have gotten finished. Using mechanical drawings allowed us to speed up fabrication of parts ten fold.

- **Help other teams!**

There is nothing better than helping to improve another team's bot! We sent a team of students and a technical mentor to 253 at SVR to work on their robot so they could play their last qualification match. The feeling when our fix to keep their battery in worked was like nothing else.

## **Writing a Business Plan**

---

Various teams share their business plans during the offseason, and for previous years. If you don't have a proper plan yet, making one is a good idea. If only to serve



as a code of conduct for working with sponsors, adding it is essential. Professional sponsors with professional recipients, especially those with a long term plan, can cultivate larger sponsorships during mergers and absorption.

- <https://www.chiefdelphi.com/media/papers/2925>
- <https://www.chiefdelphi.com/media/papers/2380>
- <https://www.chiefdelphi.com/forums/showthread.php?threadid=148799>
- <http://www.teamneutrino.org/resources/fundraising/>

## Steal from the best, invent the rest

---

- Courtesy of Michael Corsetto on Chief Delphi
- <https://www.chiefdelphi.com/forums/showpost.php?p=1517082&postcount=33>

*"I'd encourage any/all readers to avoid this "conditioning" approach.*

*If you want to win, steal from the **best**, invent the rest.*

*We (1678) have learned to use aluminum gears, cantilevered shafts, and #25 roller chain. We've learned mostly from Team 254 and VexPRO/WCP. These organizations have, between them, probably 10 of the best 50 mentors in the entire FRC program.*

*The best part is, for any reader out there, **even if you are a freshman rookie in high school**, these mentors are just an email or PM away. Ask 254 **WHY** they do cantilevered shafts every year and **HOW** they do it! Ask 1678 **WHY** we copy 254 and **HOW** we do it. Ask VexPRO/AM/WCP how to properly implement their products into your designs.*

*These resources are available. They are just an email away. You don't have to do any more guess work. You **CAN** be a better engineer by working harder and gleaning knowledge from people that have walked further down the path you are already on. Be encouraged that you are not alone, take advantage of the opportunities that are in front of you.*

*Learn from the best so you can **BE** the best."*

## Roles of Team Captain

---

- Courtesy of Conor Ryan (FTC9998)
- <https://www.chiefdelphi.com/forums/showthread.php?p=977217#post977217>

*"In my time in FRC (this is my 8th year of involvement), the best team captains on any team should have one assigned job. **Make sure everyone else on the team is busy***

**at all times.** Other than that they should delegate everything they do. But here are some other thoughts on qualifications great team captains should have:

- ability to delegate
- ability to come up with ideas and jobs for others to do (anybody ever look about how many people sit around and become disengaged?)
- ability to make quick decisions
- ability to motivate
- a work ethic to model after
- an idea of what FIRST is all about (heres a hint, its not all about the robot)
- no interest in actually building the robot (there are so many other things for a captain to do, they'll have no time for the actual robot, unless your team is smaller than 8 people (in which case you might want to try Vex).
- the idea of what a deadline is
- social skills to talk to judges/other teams/VIPs
- ability to say screw it, nothing is ever perfect and relax at the end of the day
- Being on the drive team, being the person who gets to pick the final design, all of those \*perks are not in the best interest of the team. The best leaders let those who are the best at what they do, do what they do (and then give them credit for it).\*
- Also on a note, being a senior/oldest member on the team/most experienced should have nothing to do with being team captain. Rookie teams have team captains any 9 times out of 10, nobody has any experience. Actually, some of the best team captains I've seen have been from rookie teams.

## Chief Delphi Quotes

---

Though they may not seem it, Chief Delphi Spotlights can be an interesting way to view FIRST history, as people chatter throughout the more than decade of the site's history. Examples of profoundness include:

*"Some of us should be so lucky to have something go wrong on Einstein." - Kevin Sevcik*

*"Yes ONE blue banner would be nice one of these days, but I've never lost focus of why we as mentors do what we do. It's about preparing the students for "defense" in life, and laugh when your robot gets scored into a goal." - Chris\_Elston*

*"Welcome to FIRST, the place where you can be competitive in a team. Here people can learn more in one year of FIRST than in four years of high school." - dude\_\_hi*

Just note that it can also be host to the likes of these:

*\*"Your cat-bell skills are most impressive." - Andy Baker \**

*"What is this... extreme air-keyboarding?...For those about to type, we salute you. "- Andy Baker*

*"Never underestimate people's ability to underestimate." - Ginger Power*

## Credits

Without the dedication and hard work of many people, this docu

**Students**, for being *that* type of crazy.

- Priscilla Chinchilla, 1257 (2016 President & Strategy Captain)
- Rohan Mallya, 1257 (2016 VP & Drive Coach)
- Sam Hui, 1257 (2016 Safety Captain)
- Hanna Lee-Harjono, 1257 (2016 Strategy Co-Captain & Scouting Lead, 2017 President & Strategy Captain)

**Mentors**, for being just as crazy as the students are.

- Jacqueline Gerstein, 1257 (Head Mentor)
- Matt Hagan, 1257 (Mentor)
- Adam Moskowitz, 1257 (Mentor)
- Brian Maher, 1257 (Alumnus Mentor, 2015 President / Strategy Co-Captain), 2791 (Mentor), "BMSOTM" on Chief Delphi

**More**, for finding a way to keep the madness going.

- Karthik Kanagasabapathy, 1114 (Former Mentor), VEX GDC Head
- The Developers of The Blue Alliance (too many to list)
- The Developers of QDriverStation (Team 3794)
- Brandon Martus of Chief Delphi (Webmaster)

**Founders**, for making our collective madness possible.

- Dean Kamen, Founder of FIRST
- Woodie Flowers, Co-Founder of FIRST
- Donald E. Bossi, President of FIRST

And countless others!

**Thank you!**

Tim Flynn, 1257 (2016 Member & Future Mentor), 1228 (Future Member)

Suggestions and Revisions: "tjf" on Chief Delphi.

All content is copyright of the respective owners.