

FRC 2023 Charged Up Game Analysis

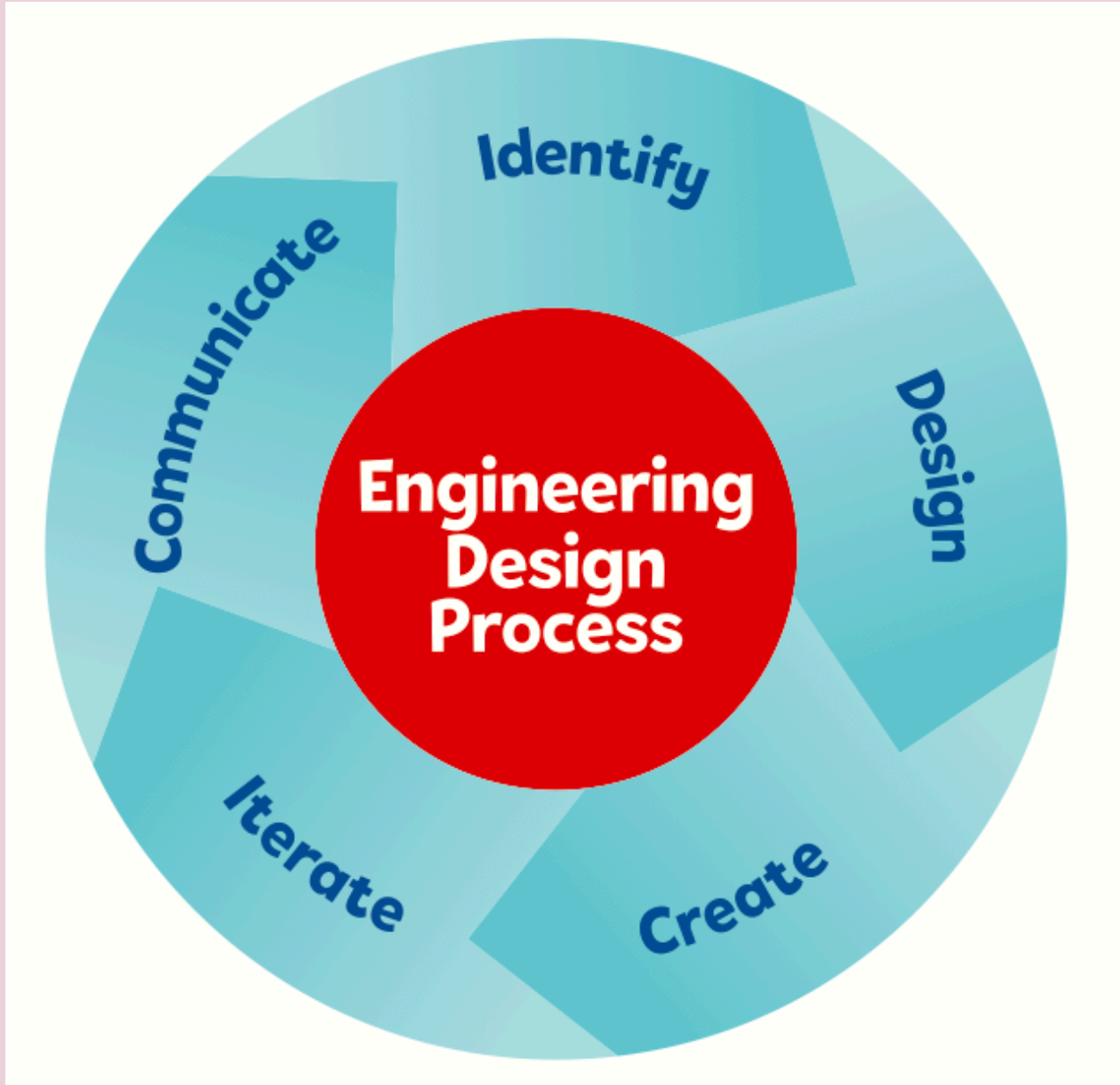
Scope

This document is a Game Analysis of the Charged Up Game. This is the For Inspiration and Recognition of Science and Technology (FIRST) Robotics Competition (FRC) game for the 2023 Season.

This Game Analysis is part of the Identify step of the FIRST Engineering Design Process. It is a study of the Problem Space for the Season. In Engineering, this is often referred to as Mission Analysis.

FIRST Engineering Design Process

The FIRST Engineering Design Process includes five steps: Identify, Design, Create, Iterate, and Communicate. A poster suitable for hanging in the workspace of this process diagram is available from FIRST at <https://firstinspiresst01.blob.core.windows.net/first-energize/fli-challenge/fli-challenge-superpowered-engineering-design-process.pdf>.



This document focuses on the Identify step. It digs deeper into the game and various game strategies. The better we understand the problem, the more likely we'll have a robot that is successful in competition.

Document Overview

This is a living document. Updates are being made on a regular basis throughout the season. Please return often to see if there have been updates. If you make a copy or print this document, those copies will not be

synchronized with this document. You may need to repeat this later if there are significant updates made.

The 2022-2023 Energize FIRST Championship has completed. There will continue to be Post-Championship tournaments that play this game. This document will continue to be updated as needed to help teams prepare for those events.

This document is one of many in [Jack's FRC Folder](#). This document can be accessed using the following QR code.



This document has been formatted to be more friendly to people with Dyslexia. Additional guidelines are available at <https://www.bdadyslexia.org.uk/advice/employers/creating-a-dyslexia-friendly-workplace/dyslexia-friendly-style-guide>.

This document is available to view by anyone with the link. If you have suggestions or corrections, please email them to jrumple.frc@gmail.com.

Referenced Materials

This section provides a list of resources referenced within this document.

- AndyMark
 - KOP AM14U Chassis Users Guide (https://cdn.andymark.com/media/W1siZiIsIjIwMjMvMDEvMDkvMTUvMzEvNDEvNTQ3MDZjNmItZmMyMS00NTQ3LWE0MWUtMjQ4MDFiYmQ5YTRjL0FNMTRVNV9Vc2VyR3VpZGVfSzIzSmFuMjAyM3YzLnBkZiJdXQ/AM14U5_UserGuide_K23Jan2023v3.pdf?sha=709f9b05a7944198)

- FIRST Inspires (<https://www.firstinspires.org/>)
 - FRC Game Manual and Season Specifics page (<https://www.firstinspires.org/resource-library/frc/competition-manual-ga-system>).
 - FRC Event Rules Manual document (<https://www.firstinspires.org/sites/default/files/uploads/frc/EventRulesManual.pdf>)
 - Inspection Checklist (<https://firstfrc.blob.core.windows.net/frc2023/Manual/2023-inspection-checklist.pdf>)
- FIRST QR Codes (https://docs.google.com/document/u/0/d/1QJ7GcDY4nKqdpvtO8pyzwtWuaobh-BaYXu_xwDSw-vQ)
- Jack's FIRST Resources
 - [FRC Season Planning](#)
- RoboZone Podcast (<https://www.spreaker.com/show/robozone-podcast>)

Additional Game Analyses

The following are game analysis for other FIRST games.

- [FRC 2026 REBUILT Game Analysis](#)
- [FRC 2025 Reefscape Game Analysis](#)
- [FRC 2024 Crescendo Game Analysis](#)
- [FTC 2025-2026 DECODE Game Analysis](#)
- [FTC 2024-2025 Into the Deep Game Analysis](#)
- [FTC 2023-2024 Center Stage Game Analysis](#)
- [FTC 2022-2023 Powerplay Game Analysis](#)

Team Goals

Before Kickoff, each team should determine what their goals are for the upcoming season. Then the students can look at the game and the design through the perspective of their goals.

All design decisions must be able to be traced back to one of the Team Goals.

Team Goals should include the robot and the More Than Robots aspect of the team's season.

Goals should be hard and stretch the team's ability so it continues to grow. Goals also need to be achievable. It is no fun to get to the end of a season and look back having not achieved any of the goals set out at the beginning.

Another part of achievable is that there has to be an end or completion point to the goal. Something like "Communicate Better" is not a goal, but a process. It is something we do every meeting and there is no way to close on the goal and say, yes, that is complete and we did it. Terms like "more," "better," "improve," and "increase" are good during the brainstorming session. Then as we're evaluating and selecting goals, ask "How will we measure that?" or "When will we know that it is completed?" Establishing quantitative measures for these concepts will create goals. A good goal based on the idea of "Communicate Better" might be something like "Publish a newsletter for school staff and parents each week between Kickoff and our last competition." We know when our last competition is because it is the one where we don't advance. We know based on the publish dates if we had one for each week.

Here are some goals that teams have used in the past. These are intended to spark ideas.

- Get selected for Playoffs
- Meet all scheduled deadlines
- Raise \$30,000 for the Season
- Compete in two Regionals (or three District Events)
- Have all tools and materials in their proper storage location at the end of each Team Practice
- Leave the work space better than we found it (particularly for shared workspaces like classrooms)
- All students maintain a B grade average for the entire Spring Semester

- This one may require some help from teammates through a homework club, study sessions, or exam preparation meetings.
- Host at least three Outreach Events
 - Outreach can include mentoring FTC or FLL teams in the area
- Mentor a Rookie Team to rank in the top half of their Regional (or District Events)
 - For example, if their Regional has 52 teams, the rookie team ranks 26th or higher.
 - Given that in 2022 the Arizona North Regional, Colorado Regional, and Idaho Regional had a rookie team as an Alliance Captain during Playoffs, this is achievable
 - This will also help the team members learn to focus on a narrow set of specific goals for their rookie team.
 - If you're in the District model, if the team ranks in the top half of either of their events, this goal can be met. Remember that you get to define the criteria for your team.
- Accumulate as a team at least 500 hours of community service
- Recruit at least one non-parent professional mentor to the team
- Host at least one demonstration for a local service organization
- Host at least one demonstration for a local small business
- Provide a robot demonstration for at least one athletics sport game halftime

There are many service organizations in your local city. Some of them are listed on the welcome sign as you drive into the city limits. Here are some ideas of other service organizations or non-profits that you can contact to arrange a robot demonstration:

- Rotary
- Optimiss
- Elk
- Loyal Order of Moose
- Kiwanis
- Toastmasters
- American Legion
- VFW

- Knights of Columbus
- The Salvation Army
- Audubon Society
- Boy Scouts
- Girl Scouts
- Boys and Girls Club
- Future Farmers of America
- 4-H
- Fraternal Order of Police
- Firefighters Association
- United Service Organizations (USO)
- United Way
- Friends of the Library
- Local Historical Society
- Local Symphony or Philharmonic Orchestra
- The more unlikely the connection with robots, the more impactful the demonstration can be. You'll be reaching a group that wouldn't normally reach out to your team.

While there are lots of ideas here, limit the team goals to four. Any more than that and the team can't keep them in mind. We want students to work every day to support the Team Goals. They need to be easy to remember and on the front of the students' minds during each Team Practice.

Team Goals must also be agreed upon before Kickoff. The goals should be independent of the season specific game. Once the game is revealed, students will promote goals that align with the game task that they want to work on the most. Goals dictate Strategy, and Strategy dictates Design. These must go in order.

Three Pillars of Success

FRC 118 shared their three pillars of success on an episode of the RoboZone Podcast:

- Strategy

- Robot
- Execution

Game Manual

This section has information about the Game Manual for this season.

Game Manual Document

For the FRC 2023 Charged Up season, the Game Manual is available at <https://www.firstinspires.org/resource-library/frc/competition-manual-qa-sytem>.

Password: #2023ReAcH4th3T0p

Prior to Kickoff, FIRST posts an encrypted copy of the Game Manual. As soon as the Kickoff completes, there is a mad rush to download the Game Manual. This puts a strain on the website and your local network connection. Team members are encouraged to download the encrypted game manual prior to Kickoff. At the end of the video, FIRST will give teams the password. They can unlock their previously downloaded copy and they don't need to worry about connection issues with all the other team members around the world and on the local network.

Game Definitions

The [Game Manual Document](#) is where you'll find Game Definitions.

It is important to take time at the beginning of the season to learn these terms and then use them throughout the season. All teams have access to these very specific definitions and will be able to understand what you're saying when you use these terms properly.

Don't come up with your own code words for things. It may be handy at the beginning of the season while you're learning the game. It will cause confusion during the Judges Interview and when trying to coordinate an Alliance Strategy while queuing for Qualification Matches. You only have a

few minutes in Team Queuing so you want to use very precise language so there is no misinterpretation by your Alliance Partner.

Get in the habit of using the precise game terminology even when you're talking with non-FIRST people, like with sponsors or during Outreach Events. You can use the term and then explain what that term is referring to. This will make it easier to stay with the specific game definitions in all your conversations.

When you have a code word system, you have to memorize two words for everything. There is the official term and your team's code word. You still need to know the official terms for discussions with Judges and with your Alliance Partners. Who has time to learn both? On top of that, you're also trying to remember to switch between the systems when talking to different audiences.

An example of something you can say when talking to non-FIRST people about the Charged Up game is the following:

We're trying to score the Cones on the Junctions, or those poles the grid formation on the Playing Field.

Just like using acronyms, once you have provided your audience with the definition of the term, you can refer to it only by the term. Just as it took you a while to learn all the terms, be patient with your audience as they are trying to learn them as well. Answer kindly with the official term when they ask about them. If they are using an unofficial term, you can repeat what they said followed by something like "also known as the TBD" and continue with your answer. They will appreciate that you respect their attempt to learn, understand what their question was, and reinforced the term so they can follow the rest of the conversation.

Fit Through Doors

Per rule [E602] in the [Event Rules Manual](#), Robot carts must fit through a standard 30" door. This is commonly used in homes for interior doors, though Jack has found some 28" doors. Interestingly, an ADA compliant

doorway is 32" wide. Jack is assuming that any venue at this point will have at least 32" for doorways that you need to take a robot through.

A KOP AM14U Chassis with bumpers installed can't meet this requirement. The shortest dimension of the Long Chassis configuration is 27". The shortest dimension of the Square Chassis configuration is 28". The shortest dimension of the Wide Chassis configuration is 24.3" (closer to 24- $\frac{1}{4}$ "). You need to add 6.5" to these dimensions to account for bumpers on both sides (2.5" for pool noodles and $\frac{3}{4}$ " for plywood). The Wide Chassis becomes 30.8" with bumpers and will barely squeeze through a 30" door.

The most common KOP Chassis uses the Long configuration. With bumpers, the shortest dimension becomes 33.5". With a little squeezing, teams can get this through an ADA compliance 32" doorway.

Kickoff Focus Area

This section has key points from a review of the rules on Kickoff Day. You must take time to go back and study the entire manual as the season progresses.

This analysis is not updated with each update of the rules. This does not substitute for each Team Member reading and understanding the rules on their own. Rules are available from the FRC Game Manual and Season Specifics page

(<https://www.firstinspires.org/resource-library/frc/competition-manual-qa-sy-stem>).

Focus on the following sections:

- Arena
- Match Play
- Game Rules: Robots
- Game Rules: Humans
- Robot Construction Rules

Arena Notes

This section has notes related to the Arena.

Sliding Output Shelves

The Double Substation has two sliding output shelves. Game Pieces can be placed on these in the Portal and then slid sideways to make them available for Robots to pick up. They are 3 ft. 1- $\frac{3}{8}$ " above the carpet, which is between the Top Row Cube Node and the Top Row Cone Node.

The Human Player can slide the shelf while the Robot is at the Substation to gather a Game Piece. This means that the robot doesn't need to be perfectly lined up with the Shelf to get the Game Piece. It does have to be within the 2 ft. 8- $\frac{1}{8}$ " travel distance of the shelf.

A Robot that can implement [Touch It, Own It](#), won't need to use the shelf. The Human Player can drop Game Pieces through the Portal so it hits the Ramp and is sitting in front of the Grate when the Robot arrives to get the Game Piece.

Charge Station Obstacle

The Charge Station creates an obstacle for robots entering and exiting their Community. It can be crossed, but it acts like a speed bump. Robots need to slow down to get over the Charge Station.

Due to the tilting of the Charge Station, it acts like an express lane on the Interstate. While a Robot is on the Charge Station, travel across it can only be in the same direction as the first robot to cross it.

In the 2021-2022 FTC Freight Frenzy game, there was a field element called the Obstacle. It had a gap that allowed small enough robots to enter and exit the Warehouse without going over the Obstacle. The most successful Robots were the one that traveled over the Obstacle and didn't have to navigate the narrow passage where there was a gap between the Obstacle and the Playing Field wall.

The layout of the Community, with the Barrier on one side and the Guardrail on the other side, creates a similar effect with the Charge Station acting as an obstacle. Like in Freight Frenzy, Robots are allowed to travel over this obstacle, but it is going to take some thought in the Robot Design and Driver practice. When you drive off the Charge Station, it returns to the Level position.

Charge Station High Center

The initial angle of the Charge Station ramp is $34\frac{1}{4}$ degrees. Once a Robot starts up the ramp, the Charge Station tilts towards it and reduces this to 11 degrees. Once they get mostly on the platform, the Charge Station returns to $34\frac{1}{4}$ degrees.

Teams need to practice at both angles to make sure their robot has enough ground clearance. On the initial climb, their bumpers farthest from the Charge Station will drop lower and may scrape along the carpet.

Once the Robot gets mostly on the platform, the Charge Station will start leveling out. This could drop the rear wheels lower based on the $34\frac{1}{4}$ degree initial setting. If the frame or belly plate is too low, it could bottom out on the ramp lifting some or all of the wheels off the surface. This is known as high centering.

If a Robot gets high centered on the Charge Station, one of their Alliance Partners needs to come and bump them off the area rubbing the bottom of the robot.

Room to Park

The Charge Station is 8 feet (96 inches) wide.

Three robots at 30" wide (standard doorway) take up 90 of the 96 inches available. That leaves 3 inches of margin between each robot. A KOP Chassis in the Long configuration with bumpers is 33.5". Three KOP robots with bumpers touching are 100.5" wide, or 4.5" overhanging the sides of the Charge Station.

Details on where the Robot has to be relative to this Field Element are provided in the [Charge Station Scoring](#) section of this document and the Game Manual.

Severe Tire Damage

This is a reference to the spikes in some parking areas, not actually damaging robot wheels.

When a robot is docked to the Charge Station and it is tilted away from your robot, there is a 71° face that is over a foot tall. Trying to cross the Charge Station in this configuration will be a challenge.

Most robots will not be able to do it. This creates a changeable, but one-way passage over the Charge Station.

Figure Eight Racing

The Charged Up Arena is like a Figure Eight racetrack. The path from the Substation to the Grid is a diagonal across the Arena. This will cause traffic patterns for the Red Alliance to cross the traffic patterns of the Blue Alliance in the center of the Arena.

Like a Figure Eight race, drivers will need to pay attention to paths of all the other robots to avoid getting hit and delaying arrival at the Grid.

Drive Towards Alliance Area

When the robot is returning from the Substation to the Grid, they are traveling towards the driver. This is when precise driving is required. It is also the most difficult orientation for a remote Driver.

Teams with Swerve Drive robots also incorporate Driver-centric Control. This means when the Driver commands the robot to go to the right, the robot moves to the Driver's right, independent of the robot's orientation.

Teams with holonomic drive systems using Omniwheels or Mecanum wheels usually start with a robot-centric control.

The Fall Guy Driver Practice

The Charge Station is a relatively tall structure in the middle of the Arena. If the robot runs two wheels onto Charge Station and two wheels stay on the ground, it has a chance of causing the robot to ride up on two wheels like the stuntmen in the TV series The Fall Guy. Unfortunately it's more likely to tip the robot over on its side.

Barrier Strike

The space between the Charge Station and the Barrier is not large. Driving fast to get into the protection of the Community while avoiding collisions with other robots will make it likely to strike the Barrier head on.

Community Traffic

The Community is much smaller in person than it appears in the diagram. There is barely enough room for one robot between the Charge Station and the Grid. Alliance Partners need to talk as they enter to place Game Pieces in the Grid. It is pretty easy to be trapped in this area.

Loading Area Traffic

The Loading Area barely has room for two robots at the Double Substation. It is best to work this one robot at a time.

Cable Protector High Center

The cable protector between the Scoring Table and the Charge Station seems small. Most teams have ignored this in previous years.

The cable protector has the same dimensions as the cable protector used in the 2022 Rapid React season. During that season, we saw several teams stuck on this part of the field because their frame bottomed out on the Cable Protector. This lifted their wheels causing a high center condition.

We also saw repeated damage to the cable protector. Many robots had low clearance and drug their frame across it which created gouges in it. It was probably also damaging these Robots.

While this seems like a simple part of the field, it is worth it for teams to build their own cable protector team element and practice driving over it at multiple angles.

Game Piece Notes

Cube Jig

Cube Jig CASD is available online.

The question is whether to make one or not. Depending on cost, it is likely a good idea to have a jig. It appears that the Cube can be inflated to various pressures causing its dimensions and behavior to change. We want to test with official game pieces at legal dimensions. Any testing outside the illegal dimensions is worthless. There is no way to correlate results to actual Match play.

Cone Orientation

There have been lots of discussions about trying to intake a Cone in all the possible orientations. Everyone is trying to keep the Cones upright, meaning with the square base resting on the carpet and the cone pointed up.

Cones can be upside down, pointing down with the square base in the air. This orientation is unstable and a light tap will put the Cone on its side.

A Cone on its side has only one edge of the square base on the carpet and the top of the cone is also resting on the carpet. For the Robot, a Cone on its side can be pointing towards the Robot (with the square base far from the Robot), pointing away from the Robot (with the square base close to the Robot), or sideways (with the square base either to the right or the left side of the Cone as the Robot looks at it).

An upright Cone is stable. It can be tipped to TBD degrees before it falls onto its side.

The most stable Cone orientation is on its side. Deliberate action must be taken to put it back into the upright orientation.

Retrieving a Soap Bubble

The Cube is light and delicate compared with the Cone. The Cone is approximately 650 grams. The Cube is a mere 70 grams. That is nearly 1/10th the weight of the Cone.

The Cube is also flexible and within the first week, some teams have already popped their Cube. They were able to repair it with electrical tape. Based on the fact that the 2022 Rapid React Cargo were routinely damaged during normal game play, we can expect Cubes to get shredded this season.

The lightweight and the easily damaged surface makes this seem like a soap bubble compared with the Cone. It reminds Jack of Snoopy's ability to retrieve soap-bubbles (June 16, 1957, <https://www.pinterest.com/pin/peanuts-by-charles-schulz-for-june-16-1957-22799541852816108/>). Maybe teams need a Bubble Blowing Snoopy toy (<https://snoopy4pnuts.com/products/bubble-blowing-snoopy-santa-toy>) in their pits.

Placing Cubes on their designated Nodes is going to be almost as challenging. The inflated Cube doesn't have a flat surface. All surfaces are rounded. This means it acts more like a ball than a cube. The Cube dropped on a Cube Node is going to bounce and roll. There is a 3 inch vertical wall surrounding the Node to help reduce this effect, but rushed or careless placement of the Cube will result in it falling off the Node and possibly getting trapped next to the fin connecting Cone Nodes.

Game Piece Herding

In the 2022-2023 FTC Powerplay game, there is a distinction between Herding and Plowing a Game Piece. The same definitions used in the FTC

Game Manual, Part 2

(https://www.firstinspires.org/sites/default/files/uploads/resource_library/ftc/game-manual-part-2-traditional.pdf), Section 4.3, are used in this document.

Herding- Pushing or moving one or more Game Piece to a desired location or direction that gains a strategic advantage beyond moving the Robot about the Playing Field. Herding is considered Control.

Plowing- Inadvertent contact with Game Elements while in the path of the Robot moving about the Playing Field that provides no additional advantages beyond field mobility.

Per Rule [G403], Robots may only Control 1 game piece at a time outside the Loading Zone and Community.

Scoring Notes

Score Table

This section provides a summary of all the scoring opportunities in the game and their point values.

Action	Points	Notes

Ranking Points

This section provides a summary of the opportunities to earn Ranking Points (RP) during a Match

- Win: 2 RP
- Tie: 1 RP

- Sustainability Bonus: 1 RP
- Activation Bonus: 1 RP

The bonus ranking points are available to any Alliance. Alliances want to focus on these ranking point bonuses during the Qualification Matches because they can improve team rankings even when the Alliance loses a Match.

The FIRST Game Design Committee (GDC) creates ranking point bonuses that require cooperation between multiple Alliance robots. All teams, including rookie teams, need to work to contribute to their Alliance's ability to earn the ranking point bonuses. This is why it is important to call out this information during the Identify step.

Sustainability Bonus

This section provides more details about earning the Sustainability Bonus ranking point. Information is provided for high performing robots and for low performing robots about ways they can contribute to their Alliance earning this bonus.

The Sustainability Bonus is based on making Links on Rows in the Grid. The only Nodes that allow the same three Game Pieces to complete a Link are the Hybrid Nodes on the Bottom Row. At some point, the Alliance must secure both Cones and Cubes in the Grid.

Without the Cooperative Bonus, it takes five Links to earn this bonus. Details on this approach are in the [Sustainability without Cooperative Bonuses](#) section. It takes three Game Pieces to complete a Link, so this would require a minimum of 15 cycles to earn this Bonus. Spread evenly, this would be five cycles per robot. During Qualifications, the lower performing teams can do three cycles if their Alliance Partners can do six without missing a Node.

With the Cooperative Bonus, it takes four Links to earn this bonus. There are three Links available in the Bottom Row. This means that the Alliance must be able to complete a Link in either the Middle Row or the Top Row.

Cooperative Bonus

This section provides more details about earning the Cooperative Bonus. This is not a Ranking Point bonus, but it makes it easier to earn the Sustainability Bonus. To earn this bonus each Alliance must place at least three (3) Game Pieces on the Co-Op Grid section. This is the middle section of their Alliance Grid. When both Alliances have at least three Game Pieces in the Co-Op Grid Section, both Alliances can earn the Sustainability Bonus with only four (4) Links, instead of the normal five.

Activation Bonus

This section provides more details about earning the Activation Bonus ranking point. Information is provided for high performing robots and for low performing robots about ways they can contribute to their Alliance earning this bonus.

The following is a summary of Charge Station Scoring from Section 6.4.2:

- Autonomous
 - Docked=8 points
 - Engaged=12
- End Game
 - Docked=6 points
 - Engaged=10 points

ID	AUTO	End 1	End 2	End 3	Points	Bonus
1	0	(6)	(6)	(6)	18	No
2	0	(10)	(10)	0	20	No
3	0	(10)	(10)	(10)	30	Yes
4	(8)	(6)	(6)	0	20	No
5	(8)	(6)	(6)	(6)	26	Yes
6	(8)	(10)	0	0	18	No
7	(8)	(10)	(10)	0	28	Yes

8	(12)	(6)	(6)	0	24	No
9	(12)	(6)	(6)	(6)	30	Yes
10	(12)	(10)	0	0	22	No
11	(12)	(10)	(10)	0	32	Yes

The scoring for Docked and Engaged applies to all robots. There is no way for one robot to be Engaged and another one to be Docked, but not Engaged.

The Activation Bonus merges Alliance performance during AUTO with Alliance performance during the End Game.

If no Charge Station points are scored during AUTO, the only way to get the Activation Bonus is for all three Robots to be Docked and Engaged. Based on the [Room to Park](#) analysis, this is going to be extremely difficult.

Foul Value

This section includes the values of the Fouls.

- Minor Foul: 5 points
- Major Foul: 12 points

Most teams ignore these until they get to their first event. Every season we see Matches won or lost based on Fouls assessed.

Charge Station Scoring

Section 6.4.2 contains all the information about Charge Station Scoring, and it is very short. Jack has found this confusing, particularly interpreting the definition of Docked.

From Section 6.4.2, "A ROBOT is DOCKED if it is contacting only the CHARGE STATION and/or other items also directly or transitively fully supported by the CHARGE STATION."

Since the criteria for an Engaged robot depends on the definition of Docked, we really need to be clear about what is considered Docked and what is not. There are two conjunctions in the definition which create branches of definitions. One is "and/or" and the other is "or." A series of scenarios will be laid out here to better illustrate how to determine if a Robot is Docked or not.

Start with the first complete sentence:

A Robot is Docked if it is contacting only the Charge Station.

This does not mean touching the Charge Station. If the wheels are on the carpet, there is contact between the robot and the carpet. Every touchpoint of the robot and something else must be of the robot and the Charge Station.

The Charge Station includes the main pivoting frame, the lead-in ramps, and the support structure. When the Charge Station is level, the first point of contact is the support structure which leads up to the ramps. The ramps are the sliding portion of the Charge Station. As the Robot advances onto the Charge Station, the main pivoting frame tilts towards the Robot and the ramps slide over the support structure, covering it up.

Research

This section includes parts of the game that the team needs to study more closely. This is done through prototyping.

Cone Stable Position

Unknown: When dropped from a Substation or from a robot, what is the stable position? In other words, what is the most likely orientation for the Cone to be in on the floor of the Arena

Experiment

Repeatedly drop Cones from the Substation. Build a chart showing the frequency of different orientations. The data set needs to be statistically significant to use in planning an Intake mechanism. This must be repeated hundreds of times. We also need to control for unintended techniques in dropping the Cones. This means we need several team members to drop the Cones from the Substation

Materials

- Team Element Single Substation
- Team Element Double Substation
- Cones
 - Having more Cones makes it easier to do data collection runs.
 - Since we need hundreds of data points, if we have to return a single Cone to the Substation for each test, it will take a very long time.

As soon as there is an initial prototype of the Cone Intake, use it to return Cones to the Human Player conducting the drop tests. Continue to collect data on the orientation of the Cone after being dropped from the Substation, but now we can test the effectiveness of the Cone Intake, and we can get valuable Driver Practice completed.

Charge Station Traction

As robots dock with the Charge Station, their weight causes the platform to pivot and slides.

How does this slide affect traction?

The surface under the front wheels moves more than the surface under the rear wheels. Do traction wheels in a differential drive chassis stick or slip or scrub the surface?

Surface will be different on an official Arena from the wood surface of the Team Element. How does this affect driving. Definitely need lots of practice at events with official fields.

Jack is assuming that KOP Chassis has been tested on the official Charge Station and there were no problems. What about different wheel upgrade kits? It is probably best to stick with the original wheels for Charged Up.

How will the high grip swerve wheels negotiate this slip? Is this going to throw off and of the control software? What about negotiating this surface while rotating?

Cone Tipping Angle

How far can you tip a Cone before it falls onto its side?

How much force is needed to tip a Cone from the upright orientation to the on its side?

Herding Over the Cable Protector

Scenario Notes

This section has notes about various game scenarios that may come up. This is an open area to work out ideas about the game and gameplay. These can include decision analyses to help with prioritizing actions or choosing a strategy.

Referee Quick Reference

An example [FRC 2023 Charged Up Referee Quick Reference](#) guide is available in Jack's FRC folder. This is only an example and teams are encouraged to build their own guide.

This is a one page guide that has a table with a summary of the rules for this season. At many events you'll see one of these taped to the referee panels. They are a quick way for the referees to refresh their memory of the various rules and the violations to record in the panel (Minor Foul, Major Foul, Yellow Card, Red Card, Disable, etc.)

While Jack has provided his own here, he encourages every Strategy Team to also build their own. The effort of building one of these guides forces you to focus on the consequences of each rule. Just like [Manual Scoring](#), you want to make it obvious to the Referees that you did not violate a rule or make it obvious that the opposing Alliance robot did violate a rule. If the Referee has any doubt about the violation, they give benefit of the doubt to the team and no foul is called.

In the example, there isn't enough room to include every rule and still be legible. Jack's judgment has been used to select the rules included and it is likely he missed one that turns out to be important during actual game play.

Pre-Match Plan

While in Team Queuing work with your Alliance Partners on the Alliance Match Strategy. Each team needs to know the following before they get on the Playing Field:

- Where to place their robot
- What game piece they want to Preload (Cube or Cone)
- What Game Pieces they want staged

The worst thing for Field Reset is when a team leaves the Playing Field and the Gates are closed and then one of the teams asks to have the staged Game Pieces changed. The pieces must be exchanged with the Game Pieces behind that Alliance's Loading Area in order to keep the number of game piece the same for each Alliance.

Before you leave the Playing Field, make sure the Game Pieces are staged properly. Once you leave the Playing Field, the Field Reset volunteers understand that you agree with the configuration.

Pre-Load Decision Analysis

This section goes through an analysis about whether to Pre-Load a Game Piece or not.

While this can be affected by the Robot design, you always want to preload a game piece.

	Preload	Don't Preload
Score	Score	Game Piece in Substation Area
Don't Score	Game Piece in Community	Game Piece in Substation Area

If you preload a game piece and score it, that is points and a fast cycle time.

If you preload a game piece and don't score it, the game piece is in the Community, which is a protected zone. Either you or your Alliance Partner can score it during TELEOP. The game piece can be herded into a Hybrid Node, earning points and contributing to a Link.

If you don't preload a game piece, it is returned to the Substation Area. In order to score this game piece, a Robot has to travel the length of the Playing Field; a Human Player has to introduce the game piece through the Portal; the Robot has

Manual Scoring

In any game with Manual Scoring, teams need to work to make their accomplishment of the score obvious to the scorekeeper.

There is a three-second delay between AUTO and the TELEOP period during which time AUTO scores are assessed.

All points are evaluated and scored by human volunteers.

Robot Actions: Autonomous

This section reviews all the Robot Actions during the Autonomous Period.

Action	Points	Easy Factor	Priority	Notes

Robot Actions: Teleop

This section reviews all the Robot Actions during the Teleop Period.

Action	Points	Easy Factor	Priority	Notes

Robot Actions: End Game

This section reviews all the Robot Actions during the End Game period.

Action	Points	Easy Factor	Priority	Notes

Touch It. Own It.

Be able to pick up Game Pieces from the Field carpet.

Look at 2017 Steamworks matches. Several teams designed Intakes to match the portal where the Human Player put Gears onto the Field. This required precise driving on the opposite side of the Field from the Driver. Even with hand gestures, this took a painful amount of time. Robots that could gather Gears from the Field carpet had the fastest cycles and could complete more per match than the other robots.

Several teams with good intakes from the floor continued to use the shelf of the Double Substation to gather Game Pieces. Jack thinks this is because it was easier to see from the Drivers Station. It is also something that could be practiced in their workspace. This seemed like the fastest, so preferred, method of gathering Game Pieces. It is also within a protected area, so the Driver didn't have to worry about being knocked around by the opposing Alliance while attempting to gather the Game Piece.

Game Pieces in the center of the field provided shorter distances to travel. Often this was complicated by Cones being tipped on their side and the robot having to approach in a specific orientation. These were also in an area subject to getting knocked around by robots on the opposing Alliance. Sometimes the defensive robots were clumsy and put the robot at risk of being contacted within the frame perimeter and damaged.

One, Two, Soccer

Many teams with clumsy arms or grippers or other manipulators spent way too much time trying to pick up Game Pieces from the ground.

Yes, if you can pick it up you can get more points in the Middle Row or the Top Row. You should try to pick it up.

But don't lose track of time and get no Node filled in.

Try it once. If that doesn't work, try one more time. If you don't get it on the second time, lift the arm and play Robot Soccer. Just herd the Game Piece by pushing it with your bumpers into the next available Hybrid Node on the Bottom Row.

When it is in the Node, go back out and try to pick up another Game Piece.

Protected Areas

In Charged Up, the Community and the Loading Zone are protected. This is different from the Launch Pad in the 2022, Rapid React, game.

A robot is not protected as soon as it breaks the plane of the protected area. Instead it must be completely inside the protected area and then if an opposing Alliance robot contacts it, there is a foul on the opposing Alliance robot.

Now, if an opposing Alliance robot breaks the plane of your protected area, you can be outside the protected area and make contact with them and the foul is on them.

Since the Community and the opposing Alliance Loading Zone are adjacent to each other, there is an advantage to a defensive robot at the corner of the Charge Station ready to ambush a robot exiting the Community. If they can push the robot exiting the Community just a foot or two into their Loading Zone, they can draw the foul from the offensive robot. See the [Protected Area Cautionary Tale](#) for details.

Protected Area Cautionary Tale

This section has a cautionary tale for offensive robots leaving their Community. Watch the following match: <https://youtu.be/dMa1Xd8RVVc>.

With 69 seconds remaining, watch in front of the Blue Loading Zone. As Red Robot 3322 leaves their Community, the Blue Robot 4453 is waiting for them to exit. The blue robot pushes the red robot around a little. Then the red Robot is pushed into the Blue Loading Zone and in contact with the Blue Robot. This is a violation of <G207> and you can see the referee call this foul on the Red Robot.

Since getting pushed around a foot or two is part of normal gameplay, this is not a violation of <G201>. There is no way for the referee to determine if

the blue robot intended to put the red robot in the Loading Zone or if that was just the result of normal defensive gameplay. There is no violation of <G201>.

The protected area provides an advantage to the defensive robot. An offensive robot needs to stay to the side of the scoring table as they exit their Community. There is no counter-play for the offensive robot to draw the foul out of the defensive robot. In order to draw the foul from the defensive robot, the offensive robot would need to lure the defensive robot all the way into their Community.

Human Player Position

Is the Human Player positioned on the opposite side of the field? Yes, in Charged Up the Human Players are on the opposite side from their Alliance's Driver Stations.

In the past, high performing teams have leveraged the visibility and human computational power of the Human Player to read the situation on the opposite side of the field and relay their findings back to the Drive Coach.

In the 2023 Charged Up game, there doesn't seem to be anything visible to the Human Player that is not also visible to the Drive Coach.

Human Player Communication

Since wireless electronic communication is prohibited, communication between the Human Players and the Drive Coaches must be visual. (While I don't think full [Semaphore Flag Signaling](#) is required, I would be impressed if a team based their signaling off this historically successful technique.)

From the Drive Coach to the Human Player

- Which Game Piece
- What Position (ground or shelf)

From Human Player to Driver

- Steering Directions
- When to close gripper
- When Game Piece is Secure

Some Drive Coaches have held up signs or color paddles to indicate which game piece they want next. One team had a two-color foam noodle they would wave depending on which game piece they wanted. The simplest and effective communication was hands over the head. If hands were vertical, the Drive Coach wants a Cube. If the hands are together in a point, the Drive Coach wants a Cone.

The more complicated hand signals were from the Human Player to the Driver. This was complicated by needing a hand free to make minor adjustments of the shelf to align with the robot's gripper or intake.

The best signaling from the Human Player was based on spotting a vehicle while it backs up. These signals account for the Driver's inability to distinguish minor depth changes from the 56 foot distance.

Flapping hands forward and backwards to indicate move forward is hard to distinguish from that distance. The fact that the Drivers could respond to this was more about the driver than the effectiveness of the communication. Keep the signals two dimensional in the same plane as the shoulders. As the robot approaches, move both arms up. If you need the robot to steer in one direction or another put that arm straight to the side and the other arm up, maybe at an angle to indicate how far away from the correct position the robot still is. When the robot is in the correct position, cross the arms. This can double as the signal to close the gripper on the Game Piece. Finally, pumping your arms vertically to indicate that the Game Piece is secure and the robot can return works. Making a Safe sign with your arms can indicate that the Game Piece was knocked out of position and the team needs to make a second attempt can also work. This will probably be followed by the Human Player grabbing a new Game Piece and positioning it on the shelf.

Substation Full Employment

The number of Human players allowed in the Substation Area is not directly specified. Jack believes there can be three individuals in this area, one from each team on the Alliance.

Section 6.6 states that each Drive Team has 1 Drive Coach, 1 Technician, and 3 additional members identified as either Driver or Human Player. The three individuals, not the Drive Coach or Technician, wear a "Drive Team" button. This indicates that there is no distinction between the Drivers and Human Players.

Rule [H310] states that prior to the start of a Match, "at least one Human Player in the Substation Area." All remaining Human Players need to be in the Alliance Area behind the Starting Line. There is no mention of a maximum number of Human Players allowed in the Substation Area.

Per Rule [H401], during the AUTO, "Human Players in the Substation Area may not contact anything in front of the Starting Lines." Jack believes this means that the Human Players cannot stage Game Pieces at the Single Substation before the TELEOP period.

There are Game Piece Holders (Section 5.8.3) for the Game Pieces. There is no mention of interaction with the Game Piece Holders. Human Players can interact with these during AUTO because they are behind the Starting Line. At the start of the TELEOP period, a Human Player can take one of these loaded as they prefer to the Single Substation.

With three teams and three Portals, there can be a Human Player from each team in the Substation Area to assist with getting the proper Game Pieces into the Arena. As a representative of the team, the Human Players can work out a visual communication with their teammates to use the Substations effectively.

Plan and Practice Hand Signals

Avoid hand signals that are in the direction of the line of sight. Flapping your hands forward and back to indicate that you want the driver to drive forward is nearly impossible to see from the Driver Station.

Hand signals need to be two-dimensional within a plane parallel to the Driver Station glass or Substation glass.

If you have ever had to spot a vehicle while it was backing up, you should know that flapping hands don't work as well as moving your arms up until they cross to indicate stop. This is much more effective.

It doesn't really matter what hand signals you use, as long as each person knows what the other is saying.

Unlike some games in the recent past, there are messages the Human Player is trying to communicate to the Driver, like "Drive forward," and there are messages that the Drive Coach is trying to communicate to the Human Player, like "Next we need a Cube."

I've seen some silly and complicated signals for what game piece the Drive Team needs next. It seems like a touchdown signal works well for a Cube and the A in YMCA works well for a Cone.

There are more messages the Human Player is trying to send to the Driver to get the robot positioned well and the Game Piece loaded. These teams should design, practice, and iterate until there is no question on either end how to get the robot quickly in position, load a Game Piece, and start heading back to place it on the Grid.

Pinning Possum

If another robot pins you and the referees start the count, when the other robot backs off, stay in your place. Act like a possum and do not move.

According to Rule <G202>, if you were pinned, the pinning robot must move 6 feet away before the count stops. However if you start moving as soon as the pinning robot backs off a foot, the referees will stop the count.

6 feet is a lot farther than most people believe it to be. It is two full robot lengths. In the past, pinning robots have backed off a foot or two and the pinned robot has moved which caused the referees to stop their count. The 6 foot rule has been there, but it hasn't been enforced since the pinned robot was free to move. Alternatively, the pinned robot was so relieved to not be pinned that they were the ones to move away 6 feet.

Playing possum, and staying still put the burden of 6 feet on the pinning robot. If they only move a little bit, the count continues. Don't make it easy on them by moving away as soon as you get an inch to move. Most teams have learned to hold the pin for 4 seconds and then they back off a foot or two. It is worth waiting the extra second for them to pause even 5 feet away and draw the foul.

Not every referee will wait for the 6 feet clearance. Many of them pause their count as soon as the pinning robot is not in contact with the pinned robot. If this happens to you, head to the Question Box. Do not expect to get the ruling from the last match overturned. This is why it is important to get clarification early in the event, during Practice if possible. The question is something like, "In that last match, the red robot had us pinned. We saw the referee start the count and as soon as the pinning robot broke contact with our bumpers, it appeared the count stopped. We only noticed three feet of separation from the pin. Can you clarify what stops the pinning count according to rule <G202>?" Whatever the Head Referee tells you is good. Thank them and return to the pits to prepare for the next match. See the [Shot Across the Bow Question](#) for more discussion on this.

Tipped Possum

This is similar to [Pinning Possum](#). If you can right the robot after being tipped over by the opposing Alliance, don't be in a hurry to do so. After being tipped over, lay still for three seconds. This should give the referees

time to call the <G206> foul. Then attempt to right the robot and continue the match.

If you right yourself too quickly, the referees may consider the tipping just part of normal gameplay and determine that it had no effect on the outcome of the match. They may allow the match to continue with no foul called.

Compete as an Alliance

It is easy to get focused on your robot and your robot's performance. These are the things that you have control of during the season. However, at this point remind yourself that we compete as an Alliance. Wins, Losses, and Rankings are based on the Alliance's performance, not the performance of any one robot.

Use the Robot Archetypes to build a variety of combinations for randomly assigned Qualification Alliances. How does your strategy compliment the other robots you're teamed with?

During Alliance Selection, the second selected robot is usually based on a robot's ability to fill a gap left by the other two robots on the Alliance. Since a lot of teams don't build for edge cases, Alliance Captains are left to pick a robot to play defense which was not designed to do so. If your robot can score based on a part of the game which has been ignored, you'll stand out and can provide an advantage to your Alliance Captain.

If you don't see a good edge case for scoring, consider designing a Defensive robot from the beginning. How can you prevent a robot from scoring? How can you draw fouls from the opposing Alliance?

Sustainability without Cooperative Bonuses

This year FIRST introduced a new bonus. In addition to having two bonuses as a way to earn additional Ranking Point, there is the Cooperative Bonus which requires both Alliances to do something that benefits both Alliances.

In general, teams don't coordinate strategy with the opposing Alliance. This will require a new level of coordination, or blind trust. This is very similar to the shared Mission in FIRST LEGO League (FLL). This is where the two competition tables overlap. Teams get points for completing their Mission, but if the team on the adjacent table also completes this Mission, both teams earn even more points.

It is possible to get the Sustainability Bonus without the Cooperative Bonus. It takes some hard work and discipline. Teams will have to determine if it is the best use of their time and abilities.

If you want the Sustainability Bonus without earning the Cooperative Bonus, you must create five Links without putting more than three Game Pieces in the Co-Op Grid Section.

There are six Links available in the two Outer Grids. The Alliance would need to get all but one of these. The Outer Grid that is next to the Barrier is the shortest distance from the Substations, but this will probably be the most defended traffic corridor. The Outer Grid that is next to the Guardrail is the longest distance, which will take the longest cycle time.

The area between the Grid and the Charge Station is only big enough for one robot. Given this traffic congestion, as of Week 2, many teams are choosing to only work the Grid at either end of the Charge Station because it is easy to get to. A couple Alliances have been able to score enough links on these end Grids and not activate their part of the Coopertition Bonus. In general, teams are not acting like they are trying to build Links. They appear to just be placing as many game pieces in the Grid as possible.

There are only two Links using the Hybrid Nodes. This means that the Alliance must fill at least three Links in the Middle Row and the Top Row.

To get all five Links there must be a Link created in each of the different types of Rows.

Three Game Pieces of any type and in any orientation in the Bottom Row of the Co-Op Grid earns the Cooperative Bonus leaving only three more Links to be created anywhere on the Grid.

Overcharging Game Pieces

A Robot is allowed to launch a Game Piece according to rule [G404]. It is restricted to only while in the Community. The tape in front of the Charge Station is considered in the Community. The Robot need only break the plane with the 2" tape to be considered in the Community.

With the Charge Station tilted away from the robot, the high point of the Charge Station is 1 ft. 4 in. above the carpet. If a robot can clear this height, they can launch Game Pieces over the Charge Station to their Alliance Partners in the Community, which is a protected area. That robot is free to return to the Loading Zone to get the next Game Piece.

This may not be combat robotics, but we can use a lifter mechanism to flip Game Pieces into the Community, over the Charge Station.

F/A-Robot Control System

The F/A-Robot Control System is inspired by the F/A-18 Super Hornet. This is the only jet that has earned both the Fighter designation and the Attack designation. A fighter jet needs to be agile and maneuverable which can make it hard to maintain a single heading more than momentarily. An attack jet needs a steady flight path to line up with a target and be able to hit it precisely. The F/A-18 achieves this with two different fly-by-wire control systems that are selected by the pilot.

The Charged Up game requires fast and nimble driving between the Loading Zone and the Community to avoid defensive robots and the crossing traffic of the opposing Alliance. This would be fighter mode. It also requires very precise driving to line up with the Cube Nodes and Cone Nodes in the Grid. This would be attack mode.

A mechanical option for switching between modes is a shifting gearbox. This allows high speed and low torque travel in fighter mode with low speed and high torque travel in attack mode. The gearbox does not address the responsiveness of the steering of the robot.

A software option for switching between modes allows multiple factors to be adjusted and optimized for Driver control of the robot.

Three Monkeys Jumping on a Bed

This is based on Room to Park analysis.

There is not room for three KOP robots with standard Long Chassis configuration and bumpers to fit on the Charge Station. Most teams with KOP chassis are building them as narrow as their motors (likely CIMs) can accommodate.

About midway three or four weeks after Kickoff, teams with swerve drive chassis were talking about driving up on the Charge Station and then moving sideways to drop two wheels off the edge making room for a third robot to drive on and Engage the Charge Station.

During a Week 0 scrimmage, some teams with KOP chassis were able to drive onto the Charge Station, perform a zero radius turn and drop their front two wheels off the Charge Station making room for the third robot to drive into the middle and Engage the Charge Station.

After considering this, the result is that now we've got robots with their front wheels low and all the wheels aligned off the Charge Station. When that third robot is running late and charges onto the Charge Station, it will rear end one of the other robots knocking it off the Charge Station and contacting the floor. It's just like the kids song about monkeys jumping on the bed. One fell off and knocked its head.

The dropped robot is now contacting both the Charge Station and the Playing Field floor, which means it is no longer Docked. Even if the Charge Station is level, the remaining two robots are Docked, but not Engaged because not all robots contacting the Charge Station are Docked. (This is the second criteria which must be met to award any robot the Docked and Engaged points.)

A Swerve Drive robot can rotate the two wheels on the Charge Station in a way that makes it harder to roll off the Charge Station. A Tank Drive or Differential Drive chassis, like the KOP chassis can't do this. They can set the motor controllers on the drive train into brake mode. This will reduce the likelihood that it can roll off the Charge Station.

If a team finds themselves in the position where they are knocked off and in contact with both the Charge Station and the Playing Field floor, the best reaction is to drive forward, completely off the Charge Station. That is providing they haven't high centered and still have enough traction to move at all. If they can get off the Charge Station, then all robots in contact with the Charge Station are Docked and it is no longer impossible to score the Engaged points and possibly the Ranking Point.

Shot Across the Bow Question

The Shot Across the Bow Question is a way to handle the situation if you feel like there has been a bad call by the referees. First, don't expect to get a call overturned from a previous match. Next, it is likely that the referees have studied the Game Manual in more detail than you have.

If you think there was a bad call, there are two possible situations:

- It was a good call.
- It was a bad call.

If you think it was bad and it was in fact a good application of the rules as stated in the Game Manual, the Head Referee will explain and clarify the rule from the Game Manual. You will have learned something new and you now can change your strategy to avoid the call in future matches.

If you think it was a bad call, and it really was a bad call, it is unlikely that the score from the previous match will be changed. In all likelihood, the Head Referee didn't see the specific situation and won't be able to confirm the bad call. Never expect a previous call to be changed. This is why you need clarification early in the event, preferable during Practice Matches, because then they have less impact on the event outcome.

If it was a bad call, the Head Referee will confirm your understanding of the rules. It is always helpful to have someone who has the training and experience of a Head Referee confirm your interpretation of the rules. The Head Referee will have a conference with the other referees at the next opportunity and reiterate the rule and the proper interpretation with them so the whole team can make better calls in the future.

The term "Shot Across the Bow" comes from old sailing ships. You may have heard in a movie a ship captain say something like, "shoot one across their bow." At the time battles were fought with cannons trying to sink the other ship. A ship had an advantage if they could reach a farther range or if they had better accuracy. A shot across the bow communicated three things to the other ship:

- We don't want to sink you and would rather negotiate.
- We have you within the range of our cannons.
- We have the accuracy to shoot over your bow and can hit your ship anywhere we want to on the next shot.

Asking a question about a bad call has a similar effect if it truly is a bad call. It lets the Head Referee know that you do understand the rules. It also tells them that you're watching for this rule to be called correctly in the future. It also says you're humble enough to admit you may have misinterpreted the rule and are interested in learning from their clarification.

After you read enough of the Q&A, listen to questions during the Driver's Meeting, and overhear enough questions in the Question Box, you start to understand that most people don't read the Game Manual very closely. They skim it for the information they want, like how many points different actions are, and then focus elsewhere. Most questions that come through the Question Box are where the team had a misunderstanding. The Head Referee prefers to provide clarification because they don't like calling fouls any more than you like receiving them. When a question comes through that is not a misunderstanding of the rules, the Head Referee notices. They certainly don't want the referee team making bad calls and they will quickly provide clarification to the referee team.

Again never go to the Question Box thinking it will change a call from a previous match. That just isn't the way things work.

Finally, be genuine about wanting clarification on a rule because if you have a misunderstanding about it, it is best to get that worked out early in the event so you have a chance to change your gameplay before it has a more significant impact on the outcome. You must enter the Question Box with the understanding that you could be wrong about the call and the Head Referee can provide a better explanation of how the rule applies during matches.

Always thank the Head Referee for taking time away from the Match Schedule to answer your question and provide clarification.

Blocking Exits Defense

The Blocking Exits Defense is parking your robot at the exit of the opposing Alliance's Community. It is already hard to maneuver in the Community. This forces all opposing Alliance robots to exit the far end of the Community or negotiate the Charge Station.

The challenge to this defense is getting pushed into the opposing Alliance's Community by a robot returning from their Loading Zone. This happened to Team TBD in the Playoffs at the PNW SunDome event. (TBD: match number and link to video)

Ambush Defense

The Ambush Defense is positioning your robot at the corner of the opposing Alliance's Charge Station near the Community exit bordered by the Barrier. As opposing Alliance robots exit their Community, advance on them and try to tangle with them. The advantage is there is a lot of room to push them towards the audience and towards your Loading Zone. If they try to avoid you, they are likely to clip the corner of your Loading Zone and potentially violate <G207>.

Rule <G201>

Team Update 15 made some changes to the blue box with Rule <G201>, don't expect to gain by doing others harm.

These came to light during Week 2 at the PNW Wilsonville District Event. Check out Qualification 52

(<https://frc-events.firstinspires.org/2023/ORWIL/qualifications/52>). The referees determined that moving the inoperative blue robot into the red Loading Zone was intended to allow them to collect fouls every time they tapped it. In the end there were 12 Tech Fouls assessed for repeated times when they contacted the inoperative blue robot.

Cube Sweep Autonomous

This strategy is to stage all Cubes during the Pre-Match Period and to pre-load a Cube. If you can, get an Alliance Partner to also pre-load a Cube.

During AUTO, drop the preloaded Cube in the Community. Then exit the Community and knock all the staged Cubes towards the Community. Make this look like plowing through them.

Leave one Autonomous routine to ignore the last Game Piece since several robots have a two Game Piece AUTO routine. They require the Game Piece to remain on its Staging Mark for their path to work.

The Cubes are lightweight and easy to knock around. A light touch can get them to "roll" a significant distance.

Robot Archetypes

This section identifies a variety of different general types of robots. These are not intended to be robot designs. They are operations concepts that can be studied.

Teams should come up with as many different archetypes as possible. This will give them more options for selecting a system level design for their

robot. These are also used to imagine various Alliance configurations and prepare Alliance Strategies before your next event.

Dozer

Dozer frequently appears in the Game Animation.

Dozer is a simple Tank Drive robot that can push Game Pieces around on the Playing Field. It is sometimes associated with rookie teams that only have the KOP Chassis assembled for their tournament.

Dozer is not to be ignored. In several seasons, a Dozer robot would be in the middle of the rankings at tournaments and would even be a viable option as a second selection for Playoffs.

For Charged Up, Dozer would be able to push both Cones and Cubes into the Hybrid Nodes. These account for one-third of the available nodes. This also accounts for the Coopertition Bonus and three Links. While Dozer is filling the Bottom Row, the other robots can be working on the Middle and High Rows.

The animated Dozer includes a blade for pushing Game Pieces around, but the actual Dozer robot doesn't require that. It would be able to push Cones and Cubes with its bumpers. Cubes are pretty easy since they are lightweight. The heavier Cones might get under the bumpers causing the robot to ride up on top of the Cone where it could get stuck.

Bumper height would need to be balanced to be high enough to allow clearance of the Cable Protector and be able to climb the steeper 35 degree angle of a level Charge Station, while also being low enough to push around Cones on the Playing Field.

Dozer is able to gather Game Pieces dropped through the Portal of the Double Substation. It may be tricky to get them pushed around and in front of the robot. Dozer is more effective with Cubes dropped through the Single Substation. Dozer can drive behind them and push them across the Playing Field. If the Human Player waits until Dozer has passed the Single

Substation, they can drop a Cube in front of Dozer, like a coin pusher game at the arcade, and Dozer can return quickly to the Community to score the Cube in a Hybrid Node.

Everybot

Each year, FRC 118, Robonauts, design, build, and provide assembly instructions for a robot that can provide minimum competitiveness for a rookie or low resource team. This is their Everybot (<https://www.118everybot.org/>).

The 2023 Robonauts Everybot Will:

In the Autonomous Period:

- Score a pre-loaded game piece
- Score Mobility points
- Dock on and Engage the Charge Station

In the Teleoperated Period:

- Score Cubes in the Bottom and Middle Rows
- Score Cones in the Bottom and Middle Rows
- Acquire Cubes and Cones from the Substations
- Play line-style defense in front of the opponents' loading zone while fully within its frame perimeter

In the Endgame:

- Dock on and Engage the Charge Station
- Be narrow enough to allow room for two other robots on the Charge Station

All Actions Robot

An All Actions Robot can perform all of the actions available in the game manual. These are going to be Alliance Captains at every event they attend, including FIRST Championships in Houston.

Autonomous Focused Robot

This robot has been designed specifically to maximize points, including Ranking Points, during the Autonomous Period. Robots are restricted to their side of the field. They only have to contend with interacting with Field Elements, Game Pieces, and Alliance Partner robots. The Field Elements and Game Pieces have well defined locations and characteristics. This means the only unknown is how your Alliance Partners' robots will perform during the Autonomous Period.

End Game Focused Robot

This robot has been designed specifically to maximize points, including Ranking Points, during the End Game.

KOP Chassis, Tuned Manipulator

The KOP Chassis, Tuned Manipulator robot is one where the team decided to use the KOP Chassis to have a drive chassis running within two Team Practices and spent the entire rest of their resources (labor hours, money, schedule) building and iterating on their Manipulator.

This robot may be slower moving around the field, but is consistent, reliable, and accurate with their game piece manipulation.

Defense Robot

The Defensive Robot is one specifically designed to prevent the opposing Alliance from scoring points. It can also draw fouls without committing them.

Most teams want to score points to win Matches. It is rare to see a robot designed from the start to play defense. Still we see in the Playoffs, many Alliances have at least one robot playing defense. Imagine if a robot was designed for this role, instead of being pressed into service for this because there was no other way to get selected by an Alliance Captain.

Points not scored by the opposing Alliance have the same effect on the Match outcome as points scored by your Alliance.

This is not Battle Bots, so it isn't about being the most brutal on the Playing Field. An elegant defense is much harder to achieve than most teams think it is. It takes just as much work to compete with an elegant Defensive Robot as it does to have a good Offensive Robot.

Shepherd Robot

The Shepherd Robot herds the game pieces from any location on the Arena to the Hybrid Nodes.

Imperial Shuttle

The Imperial Shuttle is a Lambda-class T4a Shuttle (https://starwars.fandom.com/wiki/Lambda-class_T-4a_shuttle) from Star Wars. The Imperial Shuttle first appeared in Return of the Jedi when it brought the emperor to the Death Star.

This is a concept for a buddy climb robot since there is very little [Room to Park](#) on the Charge Station for all three robots. The concept starts where the robot offers a robot lift off the short edge of the Charge Station. This would be similar to the wheelchair lifts used in buses to help passengers in wheelchairs enter and exit the bus. The biggest challenge with a lift mechanism is offsetting the weight of the lifted robot to prevent this robot from tipping over and off the Charge Station. A second platform can be deployed so a second robot can drive onto it and provide the offsetting weight which allows the robot to lift a partner on the edge.

When both platforms are folded into place, the robot will look like an Imperial Shuttle, which is where it gets its name..

This robot will also look like a butterfly or a moth with its wings folded up while it is resting.

When the platforms are folded up, they do protect the robot from having a Game Piece stuck on it. This can happen either when a Game Piece is dropped out of the Portal of a Double Substation or if an Alliance Partner is launching Game Pieces over the Charge Station, as described in the [Overcharging Game Pieces](#) section.

Levitating Robot

This robot was inspired by the climb mechanism used by FRC 1619, Up-a-Creek Robotics, in 2019, Destination: Deep Space. There were other teams that season who used similar climbing mechanisms.

The Robot places a suction pad on the main pivoting frame of the Charge Station. Then it lifts itself off the carpet with the weight on bending moment supported by the suction with the top of the Charge Station. This can be done on either of the short sides of the Charge Station. Once the wheels come off the carpet, the robot is Docked because the only points of contact are the Robot's suction pad and the main pivoting frame of the Charge Station.

Grid Optimizer

This robot can place Game Pieces at all levels and all node types. The primary focus of this robot is to move Game Pieces from one Node to a different Node because it gives more points or contributed better to building Links, including the Coopertition Grid.

There is no room in the Community for robots to pass each other. Often robots place Game Pieces in the closest Node because they can't get past their Alliance Partner to get to the best Node.

By camping out in the Community, this robot can have Game Pieces passed to them and then they position the Game Pieces in the best Nodes.

Event Notes

This section has information related to getting to an event and getting ready to compete.

Have a Plan for Pre-Match Setup

Scouting

This section has notes on Scouting for the FRC 2023 Charged Up game.

Pit Scouting

TBD

Match Scouting

TBD

Match Scouting with micro:bit

The FIRST Project Guide-micro:bit Scouting Tool document has been updated for the FRC 2023 Charged Up game.

Software is published at https://makecode.microbit.org/_D6gfo2a239EV.



Possible Strategies

This section has descriptions of some of the game strategies available to teams.

Possible Autonomous Strategies

This section has descriptions of some strategies that can be employed during the Autonomous period.

Drive Forward and Stop

The Drive Forward and Stop strategy is the easiest strategy to implement.

In Charged up this can be used to herd a Game Piece into a Hybrid Node. This can also be used to get Mobility points for leaving the Community.

Sticking to just Drive Forward and Stop, the robot can' earn both points during the AUTO period.

Hokey Pokey

The Hokey Pokey strategy is the [Drive Forward and Stop](#) strategy with a Reverse drive added at the end.

The robot drives forward herding the preloaded Game Piece into a Hybrid Node, then it reverses to exit the Community and earn the Mobility points.

It is called the Hokey Pokey because you put the robot in and then you take it out. Now you're doing the Hokey Pokey.

The Mobility points are scored manually, so teams need to make it clear that they exited the Community.

The biggest risk to trying for Mobility points is violating rule [G302] and not crossing the Centerline. The Community is not rectangular. It is shorter next to the Barrier than it is next to the Guardrail. There is still plenty of room

between the Charge Station and the Centerline. Teams should be able to get out of their Community and stop in time to stay on their side of the Field.

Swerve Plow

This AUTO strategy works for robots with Swerve Drive.

Start by staging all Cubes on the Staging Marks. During AUTO, exit the Community. Orient the robot like a diamond and drive just to the outside of the staging marks so the robot hits the Cubes with the bumpers at an angle.

You're basically orienting the bumpers like a snowplow. Then as you drive along the staged Game Pieces, they are pushed towards the Charge Station.

You want to drive fast enough that the Cubes are in the Community or on the Charge Station, but not so fast it looks like they are launched across the field.

This strategy has the most effect when driving from the audience towards the Scoring Table. You can get all four staged Game Pieces in or close to your Community.

You will want to have a version that can operate from the Scoring Table side of the field and not disturb the last staged Game Piece or the last two staged Game Pieces. There are several teams who are able to place two Game Pieces during AUTO. There are even a few who can place three Game Pieces during AUTO. Since they are scoring the Game Pieces during AUTO and the Swerve Plow is only moving the Game Pieces, these other robots score more points for the Alliance.

Possible TELEOP Strategies

This section has descriptions of some strategies that can be employed during the TELEOP period.

Low Goal Offense

TBD

High Goal Offense

TBD

Blocking Defense

TBD

Game Piece Starvation Defense

Every season we look at the potential of Game Piece Starvation as a defensive strategy.

In Charged Up, the Game Pieces are generic, meaning that either Alliance can use any Game Piece to score. In general this makes Game Piece Starvation harder to implement.

A full Grid consists of 18 Cones and 9 Cubes, assuming you put Cones and Cubes in the Bottom Row matching the Game Pieces in the Middle and Top Row. If the Bottom row only has Cones, a full Grid uses 21 Cones and 6 Cubes. If the Bottom row only has Cubes, a full Grid uses 12 Cones and 15 Cubes.

Each Alliance starts with 27 Cones and 22 Cubes. These are arranged in Pre-Match with 3 Game Piece pre-loaded, 4 Game Pieces on Staging Marks, and the remainder in the Substation Area.

In every scenario, there are plenty of spare Game Pieces for each Alliance. Since Game Pieces are not Alliance specific, any Game Piece abandoned by the opposing Alliance are available for use by your Alliance.

Supply Line Offense

The Supply Line Offense is where a Shepard Robot for the Alliance transports Game Pieces from the Substations to the Community. Their Alliance Partners stay in the Community and pick up and place the Game Pieces in the Grid.

The Shepard Robot doesn't have to orient the Game Pieces. It can push or herd the Game Piece from the Substation into the Community.

Most teams are focusing on the effort required to reorient a Cone into the upright position. This is a challenge to design. The Supply Line Offense moves this Robot Action from the Loading Zone to the Community. Both are protected areas. The Community is closer to the Driver and Co-Driver making it easier to see and work to orient the Cone.

The Cable Protector will interfere with a Game Piece being herded to the Grid.

Early Bird Offense

The Early Bird Offense collects as many of the Game Pieces from the Staging Marks as possible.

In this strategy, assign one of the Alliance robots to herd the Game Pieces from the Staging Marks to the Community. Don't worry about placing them. Just get them into the Community. Once they are there, they are under protection. If the robot is able, review the [Overcharged Game Pieces](#) section.

A second robot stays in the Community to receive and place the Game Pieces on the Grid.

The third robot depends on the herding capability of the first robot. If the first robot is an average herder, then the third robot also herds Game Pieces until they are all in the Community. If the first robot is really effective at herding Game Pieces, then the third robot heads towards the Substation and starts gathering Game Pieces from the Loading Zone.

When you count the three preloaded Game Pieces, the four Game Pieces on our Staging Marks, and the four Game Pieces on the opposing Alliance's Staging Marks, there are enough Game Pieces for three links.

Robot Soccer Offense

This strategy is to drive around pushing Game Pieces into the Hybrid Nodes of the Grid.

There are 9 Hybrid Nodes and 3 Links that are available on the Bottom Row of the Grid. This will keep any robot busy for a Match.

This strategy was able to get Team 9138, Robo Hawks (<https://frc-events.firstinspires.org/team/9138>), a slot at the FIRST Championship. They started with this strategy and played it well through Practice Matches and Qualification Matches. They were selected by the Seed 1 Alliance Captain and the Alliance went on to win the Utah Regional (<https://frc-events.firstinspires.org/2023/UTWV>).

The robot doesn't need anything more than a drive base. One of the things that 9138 did was put a protective cover over the top of the robot. This prevented Game Pieces from getting stuck on the robot leading to controlling more than one game piece outside the Loading Zone and Community (Rule <G403>).

Grid Optimization

A robot that is good at picking up Game Pieces from any orientation and placing them on the Top and Middle Rows should stay in the middle of the community and gather Game Pieces which are not part of Links and reposition them to Nodes where they do contribute to Links.

Many Alliances with robots good at picking up game pieces have left double game pieces in the Hybrid Nodes and Links missing a single Game Piece.

Jack thinks that too many teams saw the rule about messing with the opposing Alliance's Grid (<G405>) and applied it to their own Grid. They are afraid to descore any Game Pieces.

Robots are allowed to reposition Game Pieces within their own Grid as much as they want. In most cases, they can score more points by having one robot dedicated to precisely placing Game Pieces which were haphazardly placed by their Alliance Partners. Additionally, the Community is a protected area, so they don't need to worry about an opposing Alliance robot jostling them while they are doing this work. They may have to worry about an over zealous driver on their own Alliance who knocks them about.

Let's say you have an Alliance with one robot that is great at driving and placing Game Pieces, a second robot that is below average at picking up and placing Game Pieces, and a third robot that is fast moving Game Pieces into the Community but inaccurate at where they place them. The first robot should just play the game placing Game Pieces on the Grid closest to the Barrier. The second robot should camp in the Community and move Game Pieces from the outer Grids into the Cooperation Grid making sure to build Links first. The third robot should run terror across the field and quickly drop Game Pieces within the reach of the second robot, but not bothering to put them in the Grid at all.

There is some ambiguity related to Game Pieces scored during AUTO which are removed during TELEOP. This is described in the last paragraph of Section 6.4. It says that a Game Piece that is scored in AUTO and then removed during TELEOP, then the AUTO points are removed. It says if a Game Piece is scored in the same Node, the AUTO points associated with the original Game Piece are restored. This is fine for Cone Nodes and Cube Nodes. Only one Game Piece is valid for scoring in those nodes.

The confusion comes with the Hybrid Nodes. One interpretation is that if a Cube is scored in a Hybrid Node during AUTO and then it is removed and replaced with a Cone during TELEOP, the AUTO points are restored. Jack overheard that in order for the points to be restored, the same Game Piece needs to be scored in the same Node. In other words, in the scenario described above, the AUTO points for the Cube are removed, but not restored for the Cone put in its place. Jack doesn't think this is how the scoring panels were programmed, but there is room for doubt. Jack isn't willing to test this theory on an actual field in an actual match.

Game Piece Hoarding

At the start of TELEOP, gather Game Pieces from the farthest Staging Marks first. These are the ones the opposing Alliance is expecting to gather.

Start by plowing through them so you are moving one at a time towards your community. When you get to the last of the Game Pieces still available, pick it up and return it to your Community.

You can leave before it is placed. Repeat the same operation again moving several Game Pieces closer to your Community, picking up the last one, and returning it to your Community.

You're hoarding all the staged Game Pieces in your Community with the goal of placing them on the Grid only after they are all protected in your Community. This forces the opposing Alliance to make the long journey to their Loading Zone to gather more Game Pieces while one of your robots can stay in the Community and tidy things up while optimizing their positioning into Links.

Possible End Game Strategies

This section has descriptions of some strategies that can be employed during the End Game, or last 30 seconds of the Match.

Flank Exposed Offense

(edited) Jack removed this because it was based on a misinterpretation of Charge Station scoring for a Docked Robot. The wording of the definition of Docked is confusing with the use of the combined conjunction of "and/or."

Lazy Dog End Game

This end game strategy is only available for robots with holonomic drive systems. This can include Mecanum Wheel drive, though these are rare in FRC. Most robots with holonomic drive are using Swerve Drive.

This is based on the [Room to Park](#) analysis. This is the very last thing for this robot, but needs to be started a little early to give all Alliance Partners time for their part.

The holonomic drive robots drive to the middle of the Charge Station platform. Then drive sideways and drop their outboard two wheels hanging off the edge. This opens up the center of the Charge Station for a third robot in the middle. The third robot is responsible for leveling the Charge Station since the other two robots are immobilized with two wheels off the edge.

This is called the Lazy Dog End Game because the robots hanging off the edge look like a dog who has dropped their head off the edge of the front porch and just wanting to take a nap.

Kiss the Wounded

There is a very specific scenario where this can be used. It is rare, but the Drive Team should be prepared to use it.

If there is an opposing Alliance robot tipped over or otherwise unable to move a couple feet from your Charge Station, as soon as End Game starts, get as many robots as possible in contact with your Charge Station. Then drive over the Charge Station and gently tap the inoperative robot.

According to the violations for <G209>, any Robots contacting the Charge Station when the violation occurred will be considered Docked and all Docked Robots at the end of the match will be considered Engaged.

Once you've given a love tap to the opposing Alliance robot, you can continue to score Game Pieces in the Grid and completely ignore the Charge Station.

If either of your Alliance Partners were unavailable when you tapped the opposing Alliance Robot, they should do the same. They should drive from the Grid over the Charge Station and also gently tap the opposing Alliance robot.

Once is enough. You only need to do this once to get the Docked and Engaged points at the end of the match. Repeatedly tapping the opposing Alliance robot will be considered a violation of <G201> because you have stopped playing the game and are just trying to rack up points to win the match. This isn't cool. After getting the Docked and Engaged points, you want to continue playing the game by scoring as many Game Pieces in the Grid as possible.

Kit of Parts (KOP)

Swyft Robotics provided a voucher for ½" Hex Bearings. Swyft is also a great source for HTD belts.

Lessons Learned

This section has lessons learned from previous seasons. These are things to consider while developing a Strategy.

Slow and Steady Wins the Race

Do one or two things well and consistently. It may not be as flashy as a Traversal climb, but the teams that matter will notice and you'll be on pick lists for Alliance Selection.

Strategy Dictates Design

Spending an extra day or two in the Identify step before committing to a design and beginning building will save time in all the subsequent steps.

In general there is an order of magnitude savings for each step an issue is discovered early. Spending 1 hour in Identify can save 10 hours in Design, 100 hours in Create, and 1,000 hours in Iterate. Given the limited time from Kickoff to Week 1 events, it pays huge dividends to not rush through the Identify step.

Remember to build your engineering calendar with this in mind. You also can't get stuck in Analysis Paralysis. That is where you spend all your time analyzing the game and end up with no time left to design, build, and iterate the robot.

These have to be balanced.

First to Inspection; First to Practice

As soon as Inspection opens, take whatever robot you have to robot inspection. You want to be one of the first robots inspected for several reasons.

The inspectors can work with you before everything is perfect or even working. The Robot Inspectors (RIs) will run through the whole checklist and they will point out what things need to get fixed. Focus on these things and get back into inspection. After you have passed inspection, you can get some practice on the field and then work on iterations and improvements.

The official Field Elements will always work differently than the Team Elements built for the workshop. The Drive Team needs to get comfortable with the official field. The Command and Control Team needs to tune the Autonomous routines to the official field. The more times you can get on the official field, the better Qualification Matches will go.

Filler Line

During Practice Matches, most events offer a Filler Line. Teams who have passed inspection can fill in Alliance positions where teams not ready to compete have left empty.

Use the Filler Line as much as possible.

Even when the robot is not perfect, use the Filler Line and practice on the official field. You can tune and test your AUTO routine in the Practice Matches.

The official game field will always be different from the field you've previously been on. Most teams only have a room or parking lot to practice on before their competition events. The Team Elements are good, but they aren't perfect. If you want to know how your robot will perform on the field, you have to be on the field. This applies to the Practice Field at the event as well.

There will be differences between official fields at different events. At one event the field may be on top of an indoor football field. At the next event the field may be on top of an ice rink. These types of temperature differences cause the carpet to act differently. This can affect your AUTO routine.

All of these are reasons to get as much practice as possible during Practice Matches. It fills gaps and deficiencies in the Execution Pillar of Success.

Look at what the top performing teams are doing. They are on the field as much as their robot can stand. They will always be working on their robot in the pits, usually after Practice Matches have completed. They would rather be on the official field than tweaking or improving some robot feature.

Extra Practice

If Practice is going smoothly, the event staff will often play more Matches than are in the Practice Schedule. It helps teams if they just get into the habit of using the Filler Line. The staff wants teams to get as much practice as possible. It makes the competition more fun and more inspirational for everyone.

They like to run all Matches with six robots on the playing field. If no one is in the Filler Line for scheduled Matches, they will run them with a single robot.

After all Scheduled Matches are complete, there is still time left for Practice Matches, and there are robots in the Filler Line, the staff will usually just continue playing Matches. More practice for the volunteers is also appreciated.

Five (5) to Queuing

Bring five (5) Team Members to Queuing:

- Drive Coach
- Driver

- Co-Driver
- Human Player
- Technician

Everyone focuses on the roles of these individuals during Matches. They also have roles when entering the Playing Field and exiting the Playing Field:

- Driver Station Technician
- Cart Driver
- Robot Carrier 1
- Robot Carrier 2
- Flag Bearer

Each team will need to determine who wears each hat for entering and exiting the Playing Field.

Do not try to double up the responsibilities of the Flag Bearer with other team members. You have five, use all five. Every time Jack has seen one of the other four team members try to deal with their team flag, it becomes cumbersome, slow, and dangerous.

Additional details are in the [FRC Entering and Exiting Playing Field](#) guide.

Move on and off With a Purpose

Be heads up when queuing and coming off the field. The sooner you're up and running the sooner the match can start. The faster the field cycles, the more matches you'll get to play.

H301 can be violated if you take excessive time to get setup and clear the field. The violation can be Robot Disabled, prior to a Match, or a Yellow Card after a Match.

Don't Delay Match Start

Delaying the Match start hurts you the most. At most events, Matches run behind schedule. If they are far enough behind schedule, the Head Referee

and Field Technical Advisor (FTA) will cancel some of the Qualification Matches. This means you play less.

Canceled Qualification Matches also means that the Rankings are skewed. The Team Rank calculations are designed based on having enough matches to properly separate the high performing teams from the low performing teams. Fewer Qualification Matches mean that the rankings don't fully separate out the distribution of teams.

Move with a purpose. Get your radio programmed for the event as soon as possible. Put the robot down and turn it on. It takes a bit for the radio to synchronize with the Field Management System (FMS). You don't want to be the last robot ready to go. No complicated setup procedure. Your robot needs to be fault tolerant enough to do its job without precise line up.

Read the Manual

Most questions and complaints are answered in the manual. Study this carefully. If you have a question, bring your manual to the question box and get the answer from the Head Referee.

Inspect for Damage Before Exit

Before you leave the field, visually inspect your robot for damage. If you see damage that may have come from another robot, point it out to a volunteer. You want to witness before leaving the field. This is tricky because you don't want to delay Field Reset, but try to get someone else to observe the damage.

One Student; One Head Referee

Questions can only be asked in the Question Box. Coaches and Mentors are not allowed to ask questions. Two students are not allowed to ask questions. Regular Referees won't answer questions. Questions answered in the manual will be remembered and give you the visibility that you don't want.

Ground Clearance

It sounds odd, but robots are high centering on the cable protector.

Make it Obvious

TAXI points and HANGAR points are scored manually. Don't make the referees guess as to whether we've earned these points or not.

KOP Chassis is Good Enough

For most teams, the KOP Chassis is good enough. There are often KOP chassis competing in Playoffs at the FIRST Championships. AndyMark has been adjusting and improving their design every couple years. They are taking into account performance and ease of assembly into each of their iterations.

Spending time on the season specific manipulator will help you tune it to be reliable and accurate. Having the drive chassis completed in the first week allows the team to spend their precious labor hours on the Design, Create, and Iterate steps for their manipulator.

Build a Fun Picklist

Alliances are built on relationships. Performing well in Matches can be significantly enhanced when you're having fun with your Alliance Partners. Picking an unlikely partner to be on your Alliance and elevating them to get to compete in the Playoffs will mean the world to the other team. It will cement a friendship that can carry on into the Off Season where you can work together to make both teams more prepared for the next season.

In addition to building an Alliance picklist based on Match Performance, build a completely separate picklist with one criteria: What teams would we enjoy playing with in the Playoffs? (or Who seems to be having the most fun out on the field?)

You Make the Call

You Make the Call is a game you can play with your friends and teammates. After going through the rules, come up with hypothetical scenarios on the field. Then discuss the outcome as if you were a Referee for the Match.

If you and your partner disagree, how would you present your case to the Head Referee to support your case? Pretend like you're in the Question Box after the Match, remembering that video replays are not allowed, and to be respectful of the final decision by the Head Referee.

This game is much more effective if you have gone through the effort to develop your own [Referee Quick Reference](#) guide.

In the [FRC 2022 Rapid React](#) season, several teams missed that some rule violations by an opposing Alliance robot in the Hangar resulted in your Alliance earning full Transversal Climb points for the victim robot. This included contact during the last 30-seconds no matter who initiated the contact. (In other words, if a Blue robot broke down inside the Red Hangar, each Red robot could tap the bumpers of the Blue robot in the last 30-seconds of the match, continue to score Cargo in the Hub, never touch a physical Rung, and still earn Transversal Climb points. In the 2022 Beach Blitz [<https://beachblitz.ocra.io/>], this exact situation happened, but all of the Red robots avoided any contact with the tuck Blue robot. If they are reading this now, they are kicking themselves because they ended up losing the Qualification Match and Ranking Points.)

Scouting WiFi

Setting up a WiFi hotspot for scouting, or any purpose, is strictly prohibited by the rules.

The [Event Rules Manual](#), Rule <E301> prohibits setting up their own 802.11 network This includes a WiFi hotspot.

For as many team members who don't read the Game Manual, even fewer read the Event Rules Manual. That doesn't excuse setting up a WiFi hotspot

for scouting. Even though it is a separate network, it uses the same radio frequencies. This is what causes interference and leads to robots losing connectivity on the field.

Even if you don't read the Event Rules Manual, there are frequent announcements throughout the event asking people to turn off their WiFi and WiFi hotspots.

Game Manual, Section 5.10 provides details on how the Field Management System (FMS) works. This includes using WiFi access points to connect to the robots.

Background

This section has additional information that supports the information already provided in this document.

F/A-Robot Background

The 2022-2023 FTC Powerplay season had a similar requirement for both fast travel and precise alignment. The F/A-Robot Control System was assessed for this game as well.

In the Powerplay game, separating the fighter mode and attack mode between the Driver and Co-Driver seemed more appropriate. Instead of the F/A-Robot Control System, Jack recommends a Norden Bombsight Control System. In WWII, the Norden Bombsight allowed the bombardier to control the bomber during the bombing run over the target. After getting to the destination city, the pilot would turn over control to the bombardier. After the bombs were dropped, the bombardier would return control to the pilot.

Similarly a Norden Bombsight Control in Powerplay would give both the Driver and the Co-Driver the ability to control the movement of the robot. The Driver gamepad would be optimized for fast, straight travel amongst the Junctions. The Co-Driver gamepad would have slow precise directional

control of the movement of the robot to align with the Junction and place the Cone.

There is more information in the [Powerplay Game Analysis](#).

Jack recommends the F/A-Robot Control System for Charged Up because he images there will be more control inputs required of the Co-Driver in securing both the Cube and the Cone game pieces. The limited number of buttons available to the Co-Driver will likely be quickly assigned for these various robot actions.

Sponsors

This section provides information about sponsors. Many of these seem on other robots. All are worth reach out to.

- NASA
- DoDSTEM
- INCOSE
- Caterpillar
- John Deere

Most teams travel to their events. It would be helpful to have transportation and lodging companies as sponsors. If they can give the team discounts, it will really help the budget and fundraising.

FTC 2022-2023 Powerplay Inoperative Robot

There have been situations in FRC 2023, Charged Up, where Alliances have tried to take advantage of inoperative robots by placing them in protected areas, like the Loading Zone, so they can collect fouls on the opposing Alliance. In the FTC 2022-2023 Powerplay season (<https://firstinspiresst01.blob.core.windows.net/first-energize-ftc/game-manual-part-2-traditional.pdf>) they had some rules to protect against this sort of thing. They have a rule similar to the FRC Charged Up <G201>. It was <G3>, The actions of an Alliance or their Robots shall not cause an opposing Alliance Robot to break a rule and thus incur Penalties.

However there were a different combination of rules that I think are more parallel to the FRC situation. In FTC, rule <GS8a> states that a Robot may not Block the opposing Alliance Robot from Scoring a Cone on a Junction. There were situations where a robot could drive over, and thus completely block access to a Ground Junction. If a robot became unresponsive in this position, they could rack up the Penalties pretty quick.

There is also rule <G7> where a Disabled Robot (whether referee induced or Robot failure) does not earn Penalties after being declared Disabled. This gave Drive Teams the ability to disable their Robot as soon as they had exhausted efforts to regain control. By Disabling the Robot before penalties were assessed, they could avoid the Penalties and protect the Alliance. Either way the Match was over for them, so Disabling the Robot was the best sacrifice for the benefit of the Alliance.

Brake Cable

Jack is still not seeing teams using brake cable actuators. This game was a good opportunity for it. The brake cable allows force to be redirected or repositioned on the robot.

In Charged Up, there is a gripper or end effector that can be four feet beyond the frame perimeter. If you include motors at the end of the extension, it moves a lot of mass and can significantly affect the center of gravity (CG) position on the robot.

Using a brake cable with a return spring, you can keep the motors low and centered in the frame perimeter

Off Season Events

One of the first things Jack learned as a mentor is there is no such thing as an Off Season. This is why the [FRC Season Planning](#) guide was developed.

Jack prefers the term "Post-Championship" to "Off-Season." At this time that term has not caught on so be aware that these terms mean the same thing.

Tournament Trip Report

Team Members who travel for a tournament should prepare a trip report within two weeks of returning home.

This provides a description of what happened, lessons learned from the experience, ways to improve performance, and plans for how to prepare better for the next trip.

The team has paid a significant amount to get the team to the tournament. They need to get a return from this cost. If all the experience and knowledge gained stays in the individual's mind, there is no return to the team for their expense. This is why a written trip report is required.

In business, a trip report is a standard requirement following business travel. It is good to mentor students on how to do this effectively before they are required to do one for their boss.

Acronyms

This section provides a list of the acronyms used within this document.

Acronym	Definition	Notes
CONOPS	Concept of Operations	
FIRST	For Inspiration and Recognition of Science and Technology	
FLL	FIRST LEGO League	
FRC	FIRST Robotics Competition	
FTA	FIRST Technical Advisor	
GDC	Game Design Committee	
RP	Ranking Point	
TBD	To Be Determined	