

welcome TO BUSINESS 101

An introduction for newer teams

This slideshow will be shared and available for later reference!



INTRODUCTIONS

Cheryl Courson, Coach, Business Mentor for Infinity Tech Robotics

cherylcourson@gmail.com

- Engineering Portfolio
- Presentation
- Scouting
- Off Season

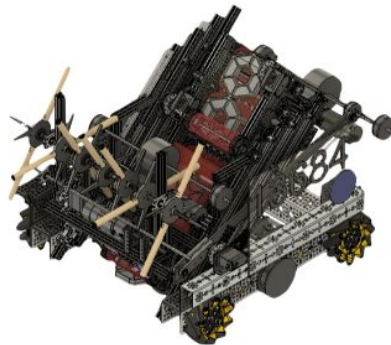


ENGINEERING PORTFOLIO

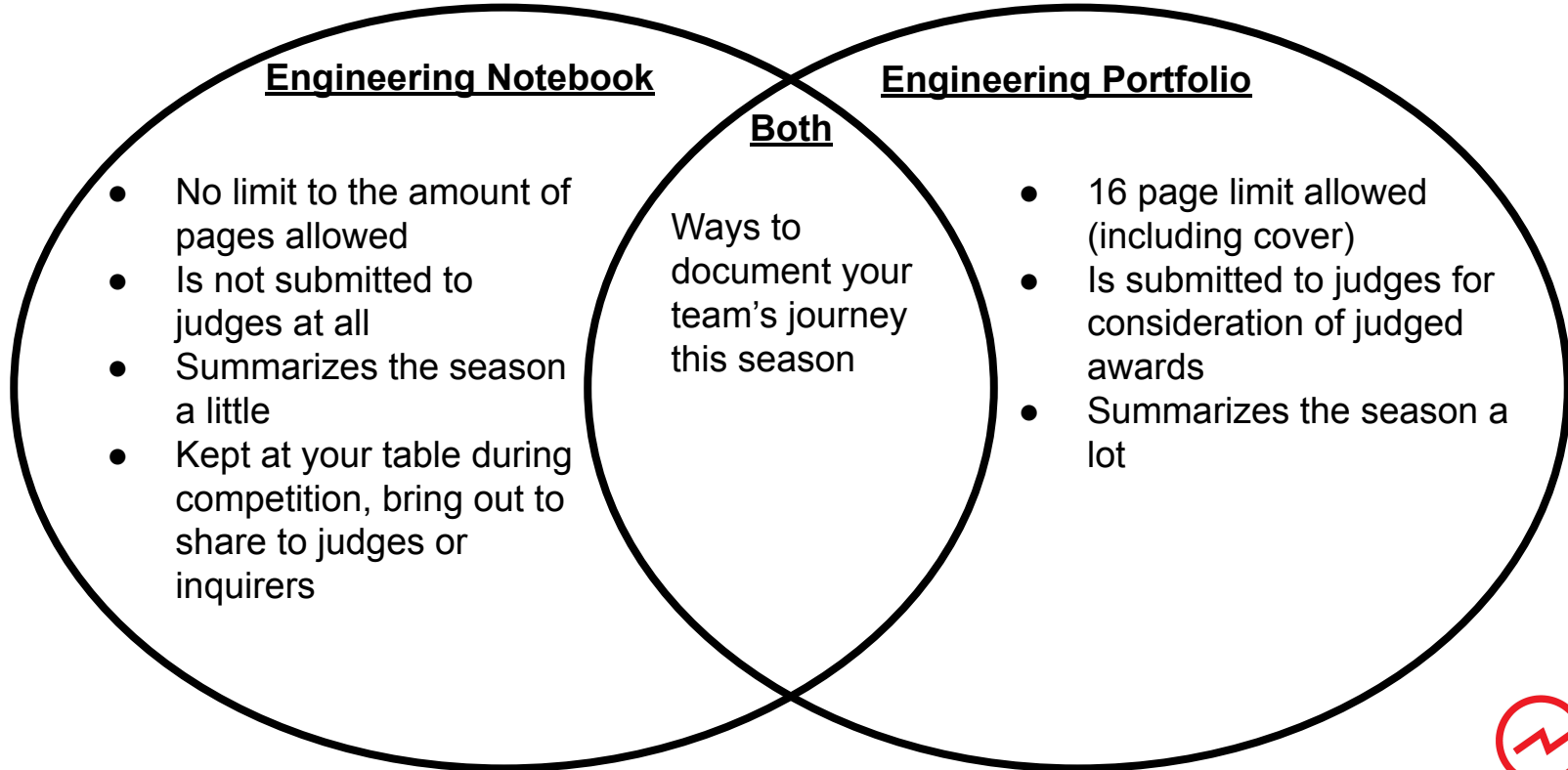


WHAT IS THE ENGINEERING PORTFOLIO?

- A summary of the team's journey during the season
 - May include:
 - CAD/Sketches. Prototypes, Mechanisms
 - Autonomous, Programming Enhancements
 - Outreach Events, Community Service, Fundraising
- Must submit in order to win awards



HOW IS IT DIFFERENT FROM THE ENGINEERING NOTEBOOK?



What are the Engineering Portfolio Requirements?

- Maximum of 16 pages
 - 1 cover page – limited to a table of contents, team information (e.g. team number, name, etc.), team photo and robot photo
 - 15 pages of content
- Cannot include links to other documents, videos, etc.
- Pages numbers and team name (recommendation)



ENGINEERING PORTFOLIO TIPS

Should Include the Following:

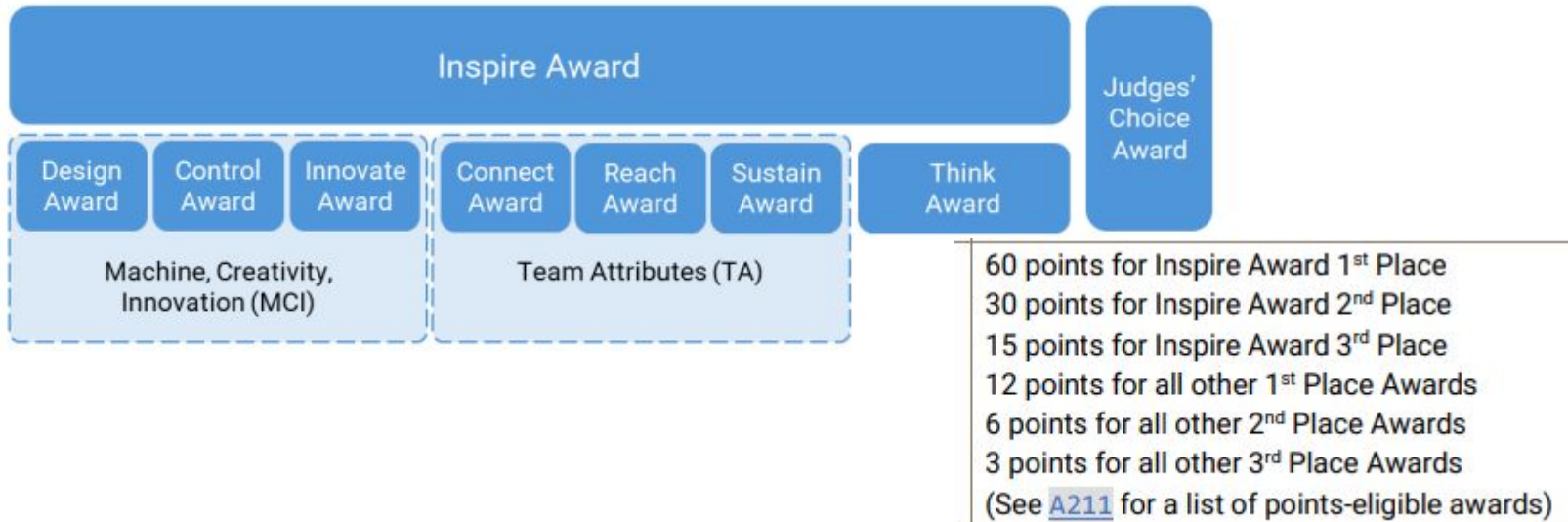
- Robot Overview
- Season Overview
- Team Information
- Funding, Sponsors & Expenses
- Sustainability
- Connections with STEM Community
- Outreach with General Community
- Working with Other Teams

<https://gm0.org/en/latest/docs/awards/portfolio.html>



Refer to the Awards Section of the Game Manual for guidance on what to include

<https://ftc-resources.firstinspires.org/ftc/game/manual>



Write clearly and succinctly

It is important to summarize your team's journey!

How can you do this?

1. Write all the information that you want to include
2. Reread your work, think about each sentence if it is really important, if not delete it!
3. See if you can rearrange sentences to decrease the size of your paragraph.

Remember to:

- Keep details, like numbers and measurables
- Keep font size at least size 10pt or above



Presentation Matters

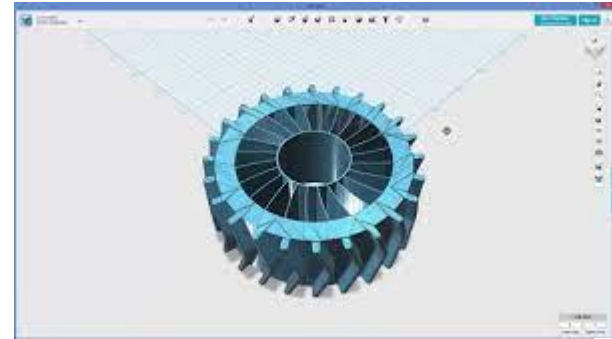
- Accents and borders
- Have a couple pages for each aspect of the robotics (intro, building, programming, design, business)
 - Building/design- Can organize by mechanism or by your team's design process
 - Programming- Can have a section for autonomous, robot enhancements, sensors
 - Business: Can organize by events or calendar year
- For all of these, we recommend putting your team's most important information first!



Visuals

Pictures are an important way to share a part of the team's journey!!

- Diagrams and CAD designs
- Graphs and flowcharts
- Pictures of outreach events help show the scale of the event
- Pictures of hand drawings
- Screenshots of email correspondence



Tell the story of your team, not just facts!

Judges are humans too, it may be easier to read a story, while fact could go over their heads.

Example: Our team talked about how we've helped grow our robotics community.

Outreach

Gallimore Robofest

The Gallimore's robotics lead reached out and invited us to mentor the Gallimore Robofest robotics teams. We helped the teams with programming and building their robots. We also volunteered at the Gallimore & World Championship (virtual) Robofest competitions. During Gallimore's Robofest season, we talked to 12 teams/~48 students about middle school robotics and had a form for those interested in robotics next year.



Caresoft Events

We visited Caresoft in Livonia and learned about benchmarking cars. We invited 2 of the rookie teams we created, but unfortunately they were unable to attend. 11 people from our team were able to attend the event. We learned about how they benchmark cars and use virtual reality (VR) to see how cars were designed. We also got a tour of their facility.



Family Robotics Event

We co-hosted an event with N.E.R.D. Bots #14353 and the Blue Googles(an FLL team). We informed families about FIRST robotics and had activities for the kids to do like driving the robot and getting a robot driver's license (Thank you Dark Matter #14374!) and making paper rockets (Thank you NASA for the template!).



Robot Driver's License

Name _____
Date _____
Signature _____

Inspired by
Dark Matter
#14374

Operations Manual

We created an operations manual for future Infinity Tech members to help them recruit new members and grow robotics in the Plymouth-Canton community. It provides step-by-step instructions and templates to reach out to schools to share a video, host workshops, start new teams, and share lessons we've learned over the years.



Portfolio examples - Show your journey!

Climbing Mechanism

Design and Functionality

Our climber consists of 4 steps:

- Step 1:** Hang on low rung bar & lift off the ground
- Step 2:** Two servo-driven rack & pinion actuators position the robot for high rung hang
- Step 3:** Pull-up on both low & high rungs
- Step 4:** Achieve a Level 3 Ascent (if desired)

See Figure E

Figure E: Our climbing process;

Mechanism evolution

How we improved our Climber using math

- 1.) Calculate work: $= mgd = (14.6 \text{ kg})(9.8 \text{ m/s}^2)(1 \text{ m}) = 143.2 \text{ J}$
- 2.) Calculate power: $W/t = 143.2 \text{ J} / 2 \text{ s} = 71.6 \text{ W}$
- 3.) Compare power result w/motor power output to DC motor curves (Figure F)
- 4.) Find motor with similar Torque/Speed ratio & test
- 5.) Keep improving to find optimal times (Figure G)

Figure F: DC motor curve

Figure G: Times and changes

Lessons learned

- Calculations & reality can be different due to friction & forces not in CAD
- Every change comes with a tradeoff
- First idea is rarely the final idea
- The quicker we test, the faster we learn

Pros/Cons list

Pros:	Cons:
• 3D-printed parts are easily redesignable	• Climbing is a 3-step process, more room for error
• Light and durable hooks	• 3D-printed parts are more brittle
• Able to hold 30+ pounds	• Climber is relatively wobbly, due to slides having weight

Infinity Tech Robotics #13684 Into The Deep 2024-2025 Season 11

Infinity Tech's 2024-2025 Into the Deep Engineering Portfolio

INTAKE SYSTEM

Design Process

V1 Belt Intake

An intake with cut timing belts to grip and propel cubes. (No grip)

V2 Tubing Intake

A surgical tubing intake with a defined path. (Often Got Possession Penalties)

V3 Updated Tubing Intake

Added a linkage gate to only intake one element. (Unreliable and slow)

V4 Short Tubing Intake

Shortened intake tube to have no transfer and added flipout capabilities. (Working)

"Touch it, Own It"

We operate on the FRC principle of "Touch it, Own it". Once an element touches our robot's intake, we control it fully, even able to **intake while driving the other direction**.

Flipout Intake

By designing a **flipout intake**, primarily intended to avoid disturbing the warehouse, we were able to better package our intake for **stability, strength, and sizing** in our small robot.

Power Transmission

Our **unique multistage power transmission** has 3d printed gears and pulleys connected and compacted as effectively as possible.

Color Sensor Detection

#16461 INFINITE TURTLES - PAGE 11



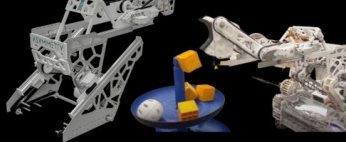
Examples of Engineering Portfolios of Teams at the World Competition

HARDWARE

6563 MSET CUTTLEFISH DEPOSIT

Far Reaching Extension

- Problem:** Strategy of scoring anywhere on hub incompatible with short extension.
- Solution:** Belt-driven angled linear slides have long horizontal and vertical extension, and an arm adds additional reach over hub and more possible deposit positions.
- Key Feature:** Optimized to extend fast while also maintaining stability.
- Constant-Force Springs** on lift counterbalance gravity to speed up extension.
- Arm and linkage driven through belt absorbs shock and keeps servos mounted low for stability.



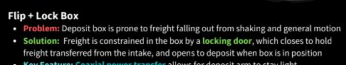
Horizontal Arm Extension

- Problem:** Unable to score against "Defensive Robots" when the opponent is directly between us and the alliance hub.
- Solution:** Pivoting arm extends out on second set of horizontal slides.
- Key Feature:** Box rotation driven through two belts coaxially with arm and box pivot shafts keeps servo completely off of the arm to reduce its moment of inertia.



Flip + Lock Box

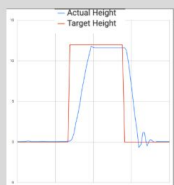
- Problem:** Deposit box is prone to freight falling out from shaking and general motion.
- Solution:** Freight is constrained in the box by a locking door, which closes to hold freight transferred from the intake, and opens to deposit when box is in position.
- Key Feature:** Coaxial power transfer allows for deposit arm to stay light.



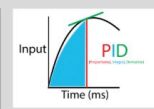
SOFTWARE

PID Control Loop

- Problem:** Gravity pulls the lift down if left unpowered.
- Solution:** We utilize a tuned PID Control Loop to adjust the height of our lift to the 3 discrete levels of the shipping hub.



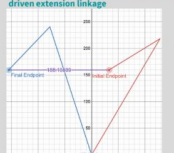
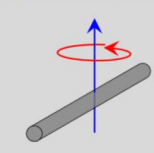
Input



Deposit Extension PID

Inertial Compensation

- Problem:** Far extension significantly increases moment of inertia, making the robot highly resistant to turns on its axis.
- Solution:** The robot internally estimates the robot's instantaneous change in moment of inertia using the estimated weighted displacement of the deposit arm, and proportionally adjusts the power delivered to turning the robot.
- Key Feature:** We layered linkage geometry equations on top of our servo-position-estimation algorithms to accurately estimate the real-time displacement of the servo-driven extension linkage.

06

#6547

COBALT COLTS
Engineering Portfolio 2023 - 2024

OVERLAND PARK
KANSAS

BRIGGET

SALE

HOMER

SIRIRAM

ASHWIN

A.C.

SAL

LEENA

REYA

IVY

DEREK

MOLLY

JOE

ARNESH

OUR TEAM:

15 Members

7 Seniors 4 Juniors 1 Freshman

3 Sophomores

TUE 7-9pm THU 7-9pm SAT 12-3pm

We're team 6547, the Cobalt Colts, based in Overland Park, KS. We're a group of people who love to learn, grow, and build robots. Not only that, we know our knowledge can help others in our community through amazing outreach. This Engineering Portfolio encompasses everything we've done - from making a wheelchair costume to using OpenCV to detect our team prop. We hope that you'll learn at least one thing about our team. Sit back, relax, and enjoy our story.

Goals for the Season:	How we Accomplished it:
Climb back to FIRST	- Hosted a meet for teams in our league - Consistently volunteered for FIRST events - Mentored 10 FLL teams at 2 elementary schools in our district weekly (we started all 10 of these teams last year!)
Make FTC easier and more fun for rookie teams	- Posted Robot in 3 Days videos on Youtube to help guide young FTC teams - Weekly office hours, where teams come to our hq for help - Trained rookie FTC Teams about the "basics" of the competition during an event at the KC STEM Alliance
Engage in more STEM outreach activities	- Missouri State Fair robotics building demo & FLL outreach - Ronald McDonald STEM Days, Trunk or Treat - After School YCare Robotics Event - Cedar Hills Elementary - Museum at Prairiefire STEM Demo
Grow FTC outside our area	- Heartland STEM support for Kansas and Nebraska FTC teams - International FTC and FLL support in Morocco and Libya - Mentoring/Starting Blue Valley School District FTC Teams

MENTORS

Coach Crocker Mr. Mitchell Mr. Dudi

*team members are not given a role for outreach because all of us do outreach!

Build **Drive** **CAD** **Documentation** **Programming**

<https://drive.google.com/drive/folders/1Ehi54myhdDn5a0OVM6q7mjSYp8ZPjSiy?usp=sharing>



Recap

Don't need to overload judges with too much information!

- Minimize words to what you really need to explain what your team has been up to during the season
- A picture is worth a thousand words
- Use frames and borders to give to judges bite size pieces to read instead of really long and dense paragraphs.



presentation



What is the presentation?

- The presentation takes place before matches in the morning on the first day
 - Generally ~8-10AM
 - During this time, robots also go in for inspection
- A 10-15 minute interview/presentation with judges
 - (2) A 5 minute presentation that is uninterrupted
 - (3) 5-10 minutes of judge Q&A
- There are different ways to display your presentation
 - BRING YOUR ROBOT
 - Skit, story, musical
 - Bring props!



Intro

- Pleasantries are important!
- Basic Information
 - Team Name
 - Team Number
 - Hometown
- Robot Information
 - Overview
 - Robot Name



Design/Building

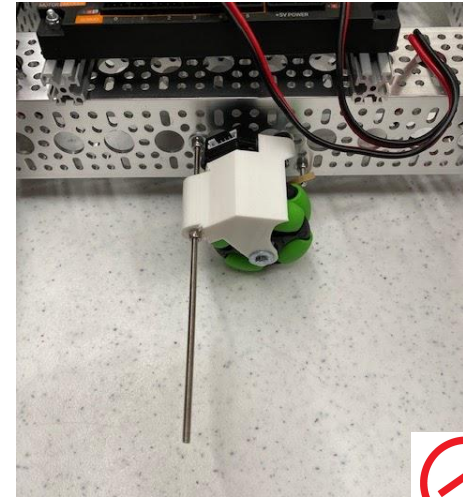
Can talk about the engineering process:

- Prototype and Design
 - Show to judges visuals in possible!
- How you team decided which mechanisms to use
- Problems and solutions of the robot
- Lesson learned while building the robot!
- Mechanisms
 - How many versions you went through
 - How a mechanism works



Programming

- Autonomous Period
 - Strategy for autonomous
 - How your team tracks where the robot was on the field
- Robot enhancements
 - How your team made your robot easier to drive
- Sensors
 - How sensors improves to robot's performance
- Talk about the challenges you faced & solutions



Business

- Outreach
 - Community events
 - Talking with the engineering community
 - Mentoring
 - Other
- Fundraising
 - Did you have sponsors?
 - Fundraisers
 - Dine to donates
 - Door to door
 - Other
- How you recruited mentors and students!



Outro

- Closing statements
 - Thank your judges
 - Remind them who your team is
- Open your presentation to questions
 - Few questions mean you did a great job answering their questions during the presentation
 - Try to remember which questions were asked so you can update your presentation to include that information for your next competition



SCOUTING



What is scouting?

Scouting is a process in which teams learn about fellow competitors whether it be digital or in-person, in order to make decisions regarding play-offs in competitions.



Why scout?

- Learn about your alliances and opponents
 - a. Records
 - b. Mechanisms
 - c. Achievements
- It comes in handy during
 - Determining your Auton strategy
 - Alliance selection for playoffs
- Scouting is helpful for talking with other teams, creating relationships, and making bonds
- Split into two parts, Pre-scout and Competition Day scout



Pre-Scout

What to do before the competition



Do your research before

- Know who your team will be facing off against
 - The Orange Alliance

<https://theorangealliance.org/>

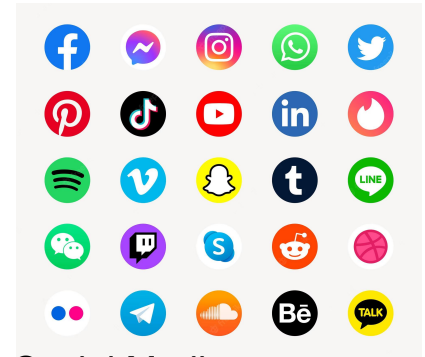
<http://www.ftcstats.org/2025/index.html>

Social Media

- Websites
- Team High Score
- See prior competition performance and rankings at
<https://ftc-events.firstinspires.org/2025#allevents>
- Alliance Picks
- Find out what teams are candidates for each award
- Check out an early Qualifier Competition as a spectator



The Orange Alliance



Social Media



The Orange Alliance Team Example

Team #13684 - Infinity Tech

Gene Haas Foundation/Hyundai Motor/Domino's Pizza&East Middle School

📍 From [Canton, MI, USA](#)

🏆 Part of the FIM Region

📅 Rookie Year: 2017

📊 Top DPR: 87.14 ([Michigan State Championship - NW](#))

Michigan State Championship - NW - Finals Division

Muskegon, MI, USA on Dec 12, 2024

Matches have not yet been reported for this event.

Michigan State Championship - NW - Marie Curie Division

Muskegon, MI, USA on Dec 12, 2024

Qual Rank #14 with a record of 4-3-0 and an DPR of 87.14

Qualifications						
🕒	Q-9	221 - 141	13684	23623	16883	22918
🕒	Q-15	154 - 155	6482	8513	23373	13684
🕒	Q-22	107 - 208	13684	21859	11228	26859
🕒	Q-28	121 - 291	13684	14788	16646	8533
🕒	Q-41	69 - 210	12862	16464	5386	13684
🕒	Q-48	172 - 175	13702	13684	23410	5618
🕒	Q-60	158 - 214	15182	13284	13684	14791

Flint Qualifier

Flint, MI, USA on Nov 22, 2024

Qual Rank #13 with a record of 3-2-0 and an DPR of 68.88



Create and Organize Your Scouting Sheets

- Find a formatted system and make Digital or Paper surveys
- What aspects are beneficial to your alliance
- Charts contain useful information
- Same page to make easy comparisons give more time to make decisions

[illegible]

Competition Day Scouting

What to do the day of the competition



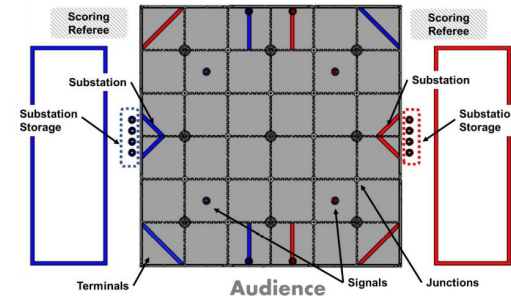
Split up into small groups to scout

- More efficient use of time
 - Teams help speed up scouting
 - Certain areas are taken by certain teams of scouts
- Let teams get to know more than just one person for your team
 - Good representation of your team
- Have more than one person provide input into your team
 - The more opinions the better!



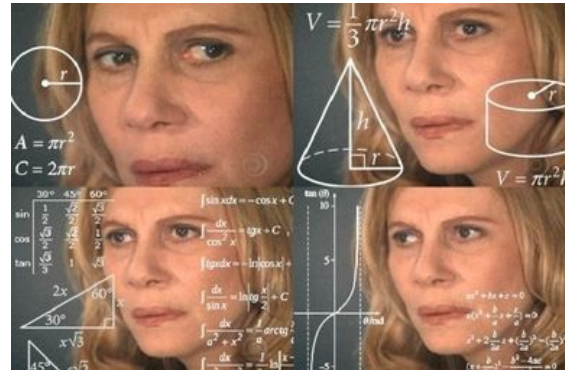
Learn about your alliances and opponents

- Abilities
 - Full capabilities
 - Cycle time
- Preference
 - Game element collection area
 - Strategy
 - Range of motion



Find the best fit for your team

- Some teams compliment each other
 - Find a team that will fit your strategy
 - Compatibility is important!
 - Do you both stay stationary
 - Two teams that specialize in defense isn't good either
 - Auton on left, auton on right?



Other Business Notes

Your Team Pit Table

- Decorate it with Team information, banner, presentation boards, or displays
- Swag/Drip for visitors
- Have a schedule for your team members to take turns manning the table – this is important if judges come around for informal pit interviews!
- Keep your Engineering Portfolio/Notebooks handy here
- You will keep robot - repair tools at this location

Your Team Lunch Table

- Find a non-coach/non-mentor parent volunteer from your team to be in charge of food and drink
- Keep all of your personal items (jackets, backpacks) at the lunch table so the pit table is not overcrowded

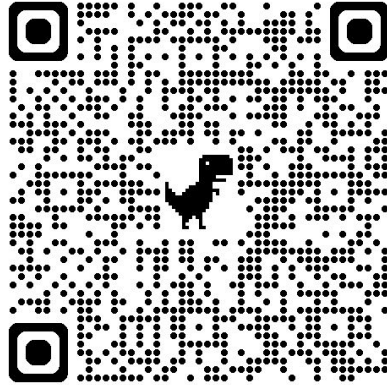
FAQs

- What do I wear to my competitions?
 - It depends on each team, but something that shows uniformity and team spirit with your team would be best (this could mean everyone on the team wearing something matching)
- What do I need to bring to my judging appointment?
 - Your engineering portfolio, control award submission (optional), and feedback request form (in some competitions, this may be collected at check-in)
 - Your robot
- What is gracious professionalism?
 - Gracious professionalism is, in a nutshell, having good team sportsmanship, gracious attitudes, respect, and gracious behaviors within and outside your team
- What do I do if I think the judges scored our match wrong?
 - One student representative must wait patiently in the designated Question box area
 - Without interrupting a match, talk to the head referee
 - If they agree about the error, they will change it; if not, you must respect their decisions.



Any QUESTIONS?

Access this slideshow later:



Resources

Game Manual Part 1 Blooket: <https://dashboard.blooket.com/set/62fbb4fe565b62c1f6ceb3f3>

Infinity Tech Website: <http://www.infinitytechrobotics.com/>

