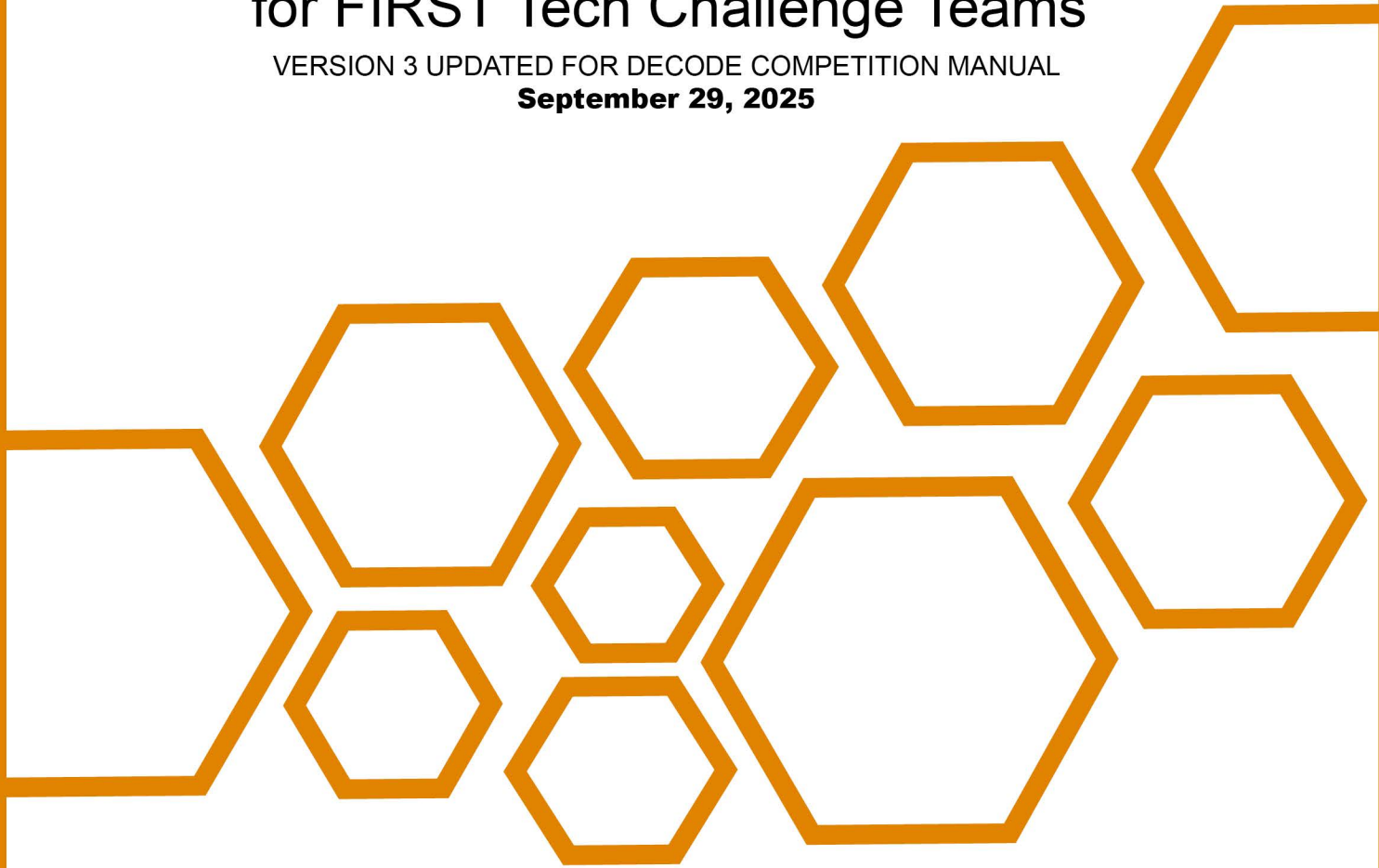


# Engineering Portfolio Resource for FIRST Tech Challenge Teams

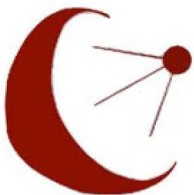
VERSION 3 UPDATED FOR DECODE COMPETITION MANUAL  
**September 29, 2025**



**Compiled by FTC Team 16091 T.W.C.A. (Team Without a Cool Acronym)**

With contributions made from teams:

11212 The Clueless  
19458 Equilibrium.exe  
11770 Curiosity  
19706 Potential Energy  
16028 Mecha Knights



## Table of Contents

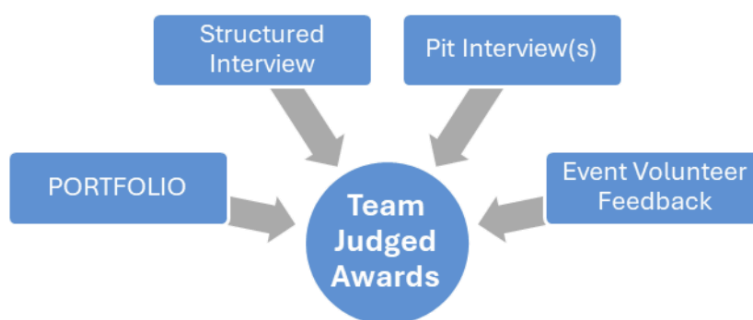
<b>Section 1</b>	<b>What is the Engineering PORTFOLIO?</b>	<b>3</b>
<b>Section 2</b>	<b>Preparing to Make Your Engineering PORTFOLIO.</b>	<b>4</b>
	- How to Outline Award Requirements Using the Competition Manual.	4
	- PORTFOLIO Requirements vs. Recommendations.	4
	- Advice From Judges on What NOT to Include.	6
	- Suggestion For Your Cover Page	6
	- Recordkeeping to Inform your Engineering PORTFOLIO	7
<b>Section 3</b>	<b>Examples of Software and Programs Used to Compile Engineering PORTFOLIO.</b>	<b>10</b>
	- 16091 TWCA (Adobe Illustrator, Adobe InDesign, Onshape).	10
	- 11212 The Clueless (Canva, Solidworks).	12
	- Matplotlib.org Resource for Charting.	13
	- 19458 Equilibrium.exe (Canva, LaTeX, Google Sheets, Google Drawing).	14
	- 11770 Curiosity Robotics (Google Docs/Slides, Onshape, Canva).	15
<b>Section 4</b>	<b>Organizing Your PORTFOLIO by Award Requirements.</b>	<b>17</b>
	- Think Award Requirements	18
	- Connect Award Requirements & Layout Ideas	20
	- Innovate Award Requirements & Layout Ideas	21
	- Control Award Requirements & Layout Ideas	21
	- Reach & Sustain Award Requirements	23
	- Design Award Requirements & Layout Ideas	25
	- Inspire Award	26
<b>Section 5</b>	<b>Finishing and Printing your Engineering PORTFOLIO.</b>	<b>27</b>

## Section 1: What is the Engineering Portfolio?

As stated in Game Manual 1 (Page 46, Revision 1.2: 10/18/2022) of the Power Play season, “An engineering **PORTFOLIO** is a short and concise summary of the Team’s journey throughout their season. The engineering **PORTFOLIO** should include sketches, discussions and Team meetings, design evolution, processes, obstacles, goals and plans to learn new skills, and each Team member’s concise thoughts throughout the journey for the season.”

In the 2024-2025 Into the Deep season, we saw a lot of changes to how we compete in FIRST Tech Challenge. This included changes to the Engineering **PORTFOLIO**. The Engineering **PORTFOLIO** is no longer a required document for Teams to be considered for awards in many categories. Still it is a vital tool in the judging process.

Figure 6-2: Sources of Information for Team Judged Awards.



Judges gather information from Teams through several pathways (Figure 6-2). *All Teams will have the opportunity to submit a written **PORTFOLIO** which should document aspects of their Teams which directly support the judged award criteria or information which they wish the judges to consider.* (Decode Competition Manual, Section 6 Awards, pg 34)

FIRST Tech Challenge team, 16091 T.W.C.A. (Team Without a Cool Acronym) experienced success during their 2019-2020 rookie season, earning the Think Award at their first qualifier. Since then, T.W.C.A. excelled in adapting to the current Engineering **PORTFOLIO** format, winning the Think Award for their division at the 2023 FIRST Championship. T.W.C.A has dedicated time to helping other Teams by providing access to their award winning **PORTFOLIOS** and providing **PORTFOLIO** mentorship.

Skystone Downloads	Ultimate Goal Downloads	Freight Frenzy Downloads	Power Play FIRST Championship Downloads	EP Resource Downloads
<b>1,533</b>	<b>8,649</b>	<b>20,245</b>	<b>12,389</b>	<b>22,120</b>

\*Download count up to August 25, 2025

TWCA felt inspired to work together with other successful interested in sharing their magic formulas. Please check out the other contributors and their Local and FIRST Championship accomplishments!

**11212 The Clueless:**  
'25 FIRST Championship  
Ochoa Inspire Winner  
<https://www.thecluelessftc.org/>

**19458 Equilibrium.exe**  
'24 FIRST Championship  
Ochoa Inspire Winner  
<https://equilibrium19458.wixsite.com/equilibrium-exe-1945>

**11770 Curiosity**  
'25 FIRST Championship  
Jemison Inspire Winner  
<https://curiosity11770.marlbrough.org/>

**19706 Potential Energy**  
'25 FIRST Championship  
Jemison Design Winner  
<https://www.potentialenergyftc.com/>

**16028 Mecha Knights**  
'23 Utah Championship  
Think Award Winner  
[www.instagram.com/mechaknights16028/](http://www.instagram.com/mechaknights16028/)

**16091 TWCA**  
'23 FIRST Championship  
Franklin Think Winner  
<https://www.twcarobotics.com>

## Section 2: Preparing to Make Your Engineering Portfolio

### How to outline award requirements using Competition Manual.

Everything you need to know about formatting and content requirements can be found in the FIRST Tech Challenge Competition Manual. For this resource, we will be referencing the DECODE Competition Manual, specifically Section 6: Awards, V0.

### General PORTFOLIO Requirements vs. Recommendations:

When creating a successful Engineering PORTFOLIO it is important to start with the correct formatting. You can find the general PORTFOLIO requirements in the Competition Manual, Page 36 (A201). When creating a new PORTFOLIO for each season, TWCA likes to print a physical copy of the Competition Manual and then highlight PORTFOLIO requirements. This helps to identify new requirements, renews knowledge for returning team members and serves as a learning opportunity for new members.

- A201** **\*Team PORTFOLIOS have limits.** Teams have the opportunity to submit a team PORTFOLIO to be used as part of the judging process. No other printed or digital content not directly included in this document will be collected by the JUDGES to consider during deliberations. PORTFOLIOS must meet the following requirements:
- must consist of 1 cover page including the team number and optionally: team name, PORTFOLIO table of contents, team organizations, sponsors, logo, motto, and picture of the ROBOT and/or team.
  - no more than 15 pages of judged content (if printing front and back, 8 sheets of paper, including the cover page)
  - use only US Letter (8.5" x 11") or A4 (210 x 297 mm) size paper.
  - font minimum of 10 point or larger
  - if submitted digitally, the complete submission must be less than 15MB in size.
  - must only include progress, challenges, and accomplishments which have taken place since January 1, 2025.



Throughout the Engineering PORTFOLIO design process, it is important to know the difference between PORTFOLIO **Requirements**, and PORTFOLIO **Recommendations**. Requirements mean that you will not be eligible for awards if specifications aren't met. Recommendations mean that covering a topic is suggested because the information could help judges make a decision about which team to award.

**None of the content of the cover page will be used by JUDGES to evaluate any awards criteria. Any content beyond the allowed 15 pages will not be reviewed by the JUDGES.**

**Teams are encouraged to limit Personally Identifying Information (PII) in the PORTFOLIO. Best practices would be to use only first names and optionally last initials of STUDENTS. Photographs including images of STUDENT team members are acceptable. The JUDGES use the cover page to identify the team associated with the PORTFOLIO. Teams who forget to include a cover page may be disqualified from judging if the JUDGES cannot determine what team the PORTFOLIO is associated with.**

**Teams should carefully consider font size, color, and graphic design when making their PORTFOLIO so that all JUDGES are able to read their submission. Teams whose design choices include small fonts (<10 pt) or low contrast text on images will not be excluded from consideration but understand that JUDGES will not be able to use anything they cannot read. Teams can use various free accessibility tools, like WebAIM Contrast Checker, to help them design with readability in mind.**

**JUDGES will not open, view, or use any included links to other documents, websites, or videos referenced to linked to from the PORTFOLIO. JUDGES may Section 6 Awards (A) V0 37 of 94 read additional information during pit interviews but will not bring back additional printed content to be referenced as part of the JUDGE deliberations.**

**Teams may use writing and research aids including Artificial Intelligence (AI) to help them compose their PORTFOLIOS. If AI or other resources are used, they must be credited via footnote or endnote, and respect intellectual property rights and licenses. Proper Credit can look like this :”PORTFOLIO created by Team XXXXX and ChatGPT”.**

**A team may reference previous seasons (for example, in a team or organizational plan) to demonstrate growth, but the emphasis must be on the current season.**

PORTFOLIO Criteria		
<b>Required</b>	1	<ul style="list-style-type: none"> <li>A. 1 cover page</li> <li>B. team number must appear on the Cover Page</li> <li>C. 15 pages of content maximum</li> <li>D. must use standard size 8.5x11 or A4 (210 x 297mm) paper.</li> </ul>
<b>Encouraged</b>	2	<ul style="list-style-type: none"> <li>A. page number on each page</li> <li>B. font minimum of 10 point or larger</li> <li>C. divide content into specific areas</li> <li>D. use consistent branding throughout your PORTFOLIO (readable fonts, colors, graphics)</li> </ul>
<b>Do Not Include</b>	3	<ul style="list-style-type: none"> <li>A. links to other documents, websites or videos.</li> <li>B. information not tied to a specific criteria of a judged award</li> <li>C. hard luck stories</li> <li>D. personal information such as last names, or identification going against FIRST's Youth Protection Policy.</li> <li>E. content displaying poor core values and/or Gracious Professionalism.</li> </ul>

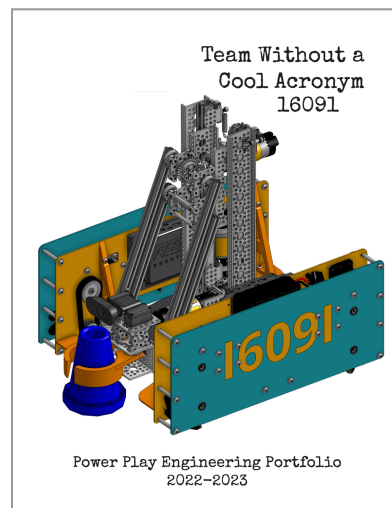
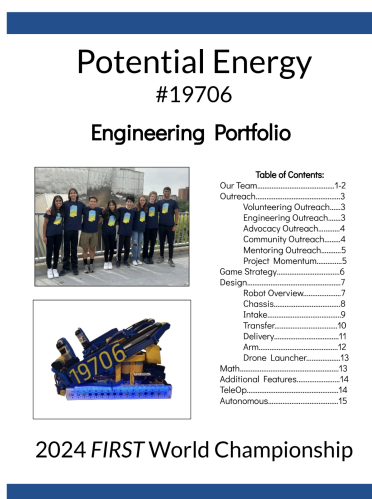
### **Advice from regional and FIRST Championship judges on what not to include:**

"If it's not directly tied to a judged award, don't include it. Judges have a very short amount of time to make decisions about who qualifies for awards and who doesn't. Teams need to make every word count when going for the highest level of competition." - *Lafe Peavler, Utah Region*

**Why not "Hard Luck Stories?"** Teams are encouraged to share challenges they have faced and how they overcome these challenges. This is different from Hard Luck Stories. According to the 2023 - 2024 Judges Manual (Revision 1: 10.2.2023, pg 31), Awards should not be given based on a hard luck situation. For every hard luck story uncovered by the judges, there are many more that are not uncovered. All awards should be granted based on something positive and uplifting. Rather than rewarding a team for the hardships they had; reward them for their perseverance, determination, or unique problem-solving skills. The goal is to present each award winner to the audience as exhibiting role-model FIRST behavior, rather than presenting them as a victim of circumstance.

### **Suggestions For Your Cover Page:**

Teams tend to use the cover page strategically, using the space to introduce themselves to the judge by using branded photos or artwork. It is acceptable to use this space to also place a table of contents to help judges quickly find content. **You MUST put your team number on the cover** or judges will not continue to look at your PORTFOLIO and you will not be considered for any judged awards.



The cover page examples show a variety of methods to present the PORTFOLIO. All Teams included their Team numbers and the name of their Team. The only requirement is the Team number, but the other information is helpful in helping judges quickly identify the Team on a tight judging schedule.

Teams that put a lot of effort into their robot's design and innovation often choose to highlight their robot on their cover by using stylized photography or CAD renderings.

### **Record Keeping to Inform your Engineering Portfolio:**

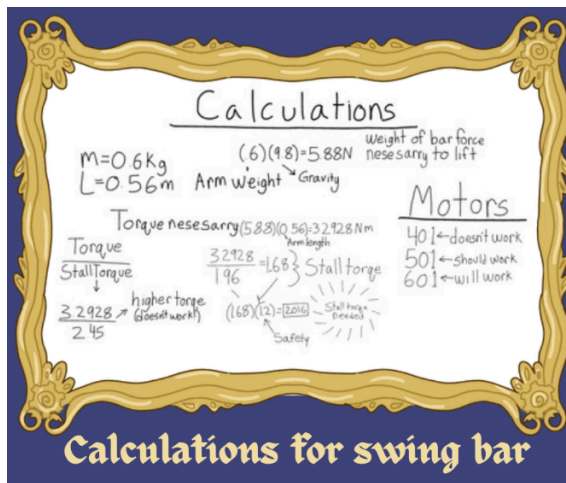
Once you know the requirements and recommendations, and have thought about your cover page, you will need to fill the Engineering PORTFOLIO with content. Consider this advice from **19458 Equilibrium** on keeping an Engineering Notebook, although not required:

"The Engineering Notebook is important for keeping detailed records of what happens during the season and preseason. By the time we make our PORTFOLIO it is usually later in the season and we might not remember details about some events we did in the early preseason. By having an EN [you] can refer to it for specific details about events."

**11770 Curiosity** adds that their team uses several notebooks throughout their season. They use a combination of pictures, Google Docs and handwritten notebooks to document as much as their season as possible. Major meetings, outreach events, or iterations in robot design are diligently documented allowing them to easily transfer the information into their PORTFOLIO. This eases the PORTFOLIO creation process for them because they aren't scrambling to find pictures from early iterations or notes from past outreach events.

Nothing the judges are looking for is a secret! By referring to the official Judge Manual, you will be able to tailor your season's documentation to fit what they are looking for:

[https://www.firstinspires.org/sites/default/files/uploads/resource\\_library/ftc/judge-manual.pdf](https://www.firstinspires.org/sites/default/files/uploads/resource_library/ftc/judge-manual.pdf)



### Take Photos of Whiteboards:

The appeal of whiteboards is that they are big and erasable so that they can be easily seen and reused. The erasable function isn't helpful if you've erased something that would help you in your engineering PORTFOLIO, or if you need to reference a calculation for a part you are building. Always make sure to take photos of your whiteboard brainstorm sessions and math calculations because these are important items to include in your EP! Judges love to see Teams document how calculations inform design decisions on their robot.

### Take General Photos of Outreach and Meetings:

Take photos at every community/outreach event and at meetings. This form of record keeping helps Teams remember what happened at different events/meetings and the photos can be used as visuals in your Engineering PORTFOLIO. Taking digital photos is also helpful because they are automatically time stamped. This information can help you put a season timeline together.

#### Zoom Meetings with Teams.



Some of the teams we met with were Dark Matter, Haywired, Wolfpack Machina, Robotech Anomaly, and SIGMA from Mumbai.

#### We Coached 2 FTC Teams.

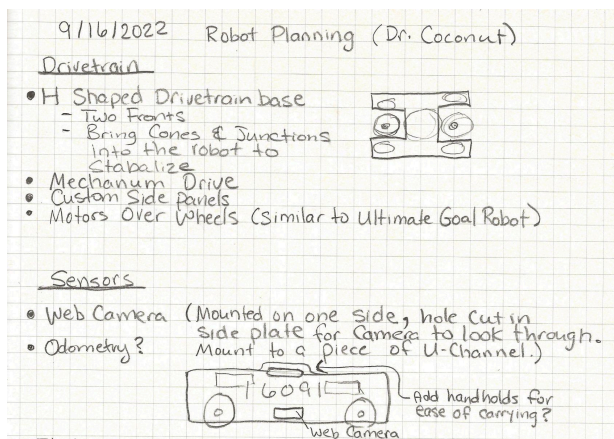


We started two FTC teams this season Dreamliner and B.A.M. and have been mentoring them every Thursday since September.

#### Weekly Farmer Market Demo.



We did robotics demos at farmer's markets most Saturdays May 2023 through October 2024.



### Keep a Handwritten Engineering Notebook:

**16091 TWCA** always keeps a handwritten engineering notebook to organize their ideas during the brainstorming process or when they need to figure out math for things like gearing ratios. They also keep track of things like pseudocode for how they would like their autonomous programs to work or strategic plans for how they would like to score points

during autonomous. To the left you can see an example of one of their handwritten engineering notebook pages where the team brainstormed ideas during the first week of the Power Play season. Their handwritten notebook is leather bound with engineering lines, which is helpful to keep the pages together and to sketch ideas for parts to scale.

### **Keep Track of Volunteer and Outreach Numbers:**

If you are an outreach and volunteer heavy team, judges don't have time to read about all of your efforts. TWCA found that quickly displaying your most important numbers while highlighting a few of your favorite events is the best way to grab judges attention, encouraging them to find you in the pits to ask for more!

Example of volunteer and outreach numbers tracked in TWCA's Engineering Notebook and then summarized in an informative graph (page 10):

**TWCA Website and Engineering Portfolio Stats 2023 - 2024 CENTERSTAGE**

Website Views April 2023 - March 1, 2024: 12,939  
All Time Website Views: 28,743



**Engineering Portfolio/Notebook Downloads (March 1, 2024):**

2018	0
2019	6
2020	262
2021	1,484
2022	18,676
2023	10,538
2024	4,242
TOTAL	35,208

**Engineering Portfolio Resource Downloads (March 1, 2024)**

2023	6,358
2024	4,433
TOTAL	10,791

**Notebook/Portfolio/Resource All Time Downloads (March 1, 2024)**

All Time	45,999
----------	--------

**Social Media Outreach 2023 - 2024 CENTERSTAGE**

#### **TWCA Social Media (March 1, 2024)**

TikTok Followers: 523  
Instagram Followers: 1,674  
Facebook Followers: 55  
YouTube Subscribers: 60

#### **TOTAL CENTERSTAGE SOCIAL MEDIA IMPACT ACROSS ALL PLATFORMS:**

**1,887,938 INTERACTIONS**

#### **TOTAL TIKTOK VIEWS**

Dan Povenmire/TWCA Collaboration total TikTok	104,600
TWCA Total TikTok	10,598
<b>TOTAL CENTERSTAGE TIKTOK VIEWS</b>	<b>112,236</b>

#### **TOTAL YouTube VIEWS**

Dan Povenmire/TWCA Collaboration total YouTube	52,227
TWCA Total YouTube	1,380
<b>TOTAL CENTERSTAGE YouTube VIEWS</b>	<b>52,703</b>

#### **TOTAL Facebook VIEWS**

Dan Povenmire/TWCA Collaboration Total Facebook	1,600,000
Swampy/TWCA Collaboration Total Facebook	41
TWCA Total Facebook (Reel Views and Post Likes)	535
USU Extension/TWCA Collaboration Facebook - 4H Video Views	142
<b>TOTAL CENTERSTAGE Facebook VIEWS</b>	<b>1,600,718</b>

#### **TOTAL Instagram VIEWS & LIKES**







































Dan Povenmire/TWCA Collaboration total Instagram	100,000
TWCA Total Instagram Reel Views	18,387
TWCA Total Instagram (non-reel) Post Likes	3,894
<b>TOTAL CENTERSTAGE Instagram VIEWS</b>	<b>122,281</b>

### **Turning your Records into Charts, Graphs and Infographics:**

Teams use different methods summarizing their documentation for the Engineering PORTFOLIO. Many Teams will create handwritten or digital charts and graphs. **16091 TWCA** uses Adobe Illustrator to make charts and infographics of various kinds. Below is an infographic TWCA used to tell the story of their growth and sustainability by acquisition of sponsors over several seasons.



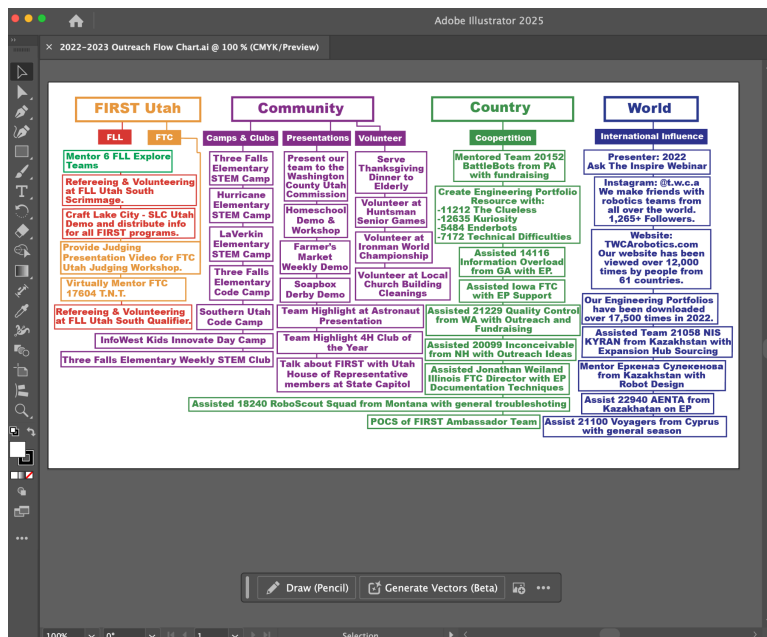
### University & Business Partners/Sponsors

2019-2020 Skystone	2020-2021 Ultimate Goal	2021-2022 Freight Frenzy
         	           	               
10	17	23

We had 16 returning and 7 new partners/sponsors for the 2021-2022 Freight Frenzy season!

## Section 3: Software and Programs Used to Compile Engineering Portfolios

### 16091 TWCA - Adobe InDesign, Adobe Illustrator & Onshape:



### Adobe InDesign Paired with Adobe Illustrator:

Adobe Creative Suite is an amazing creative tool. The downside is that it isn't free. TWCA has a strong graphic design background and therefore the Adobe Creative Suite is a necessary tool in their branding and marketing plan. TWCA has a student subscription to the full creative suite. To cover the approximate \$255 yearly subscription, TWCA adds this to their yearly budget plan and fundraises to cover the cost. In addition to Engineering

PORTFOLIO creation, TWCA also uses the Adobe Creative Suite for video editing in their social media projects and presentations.

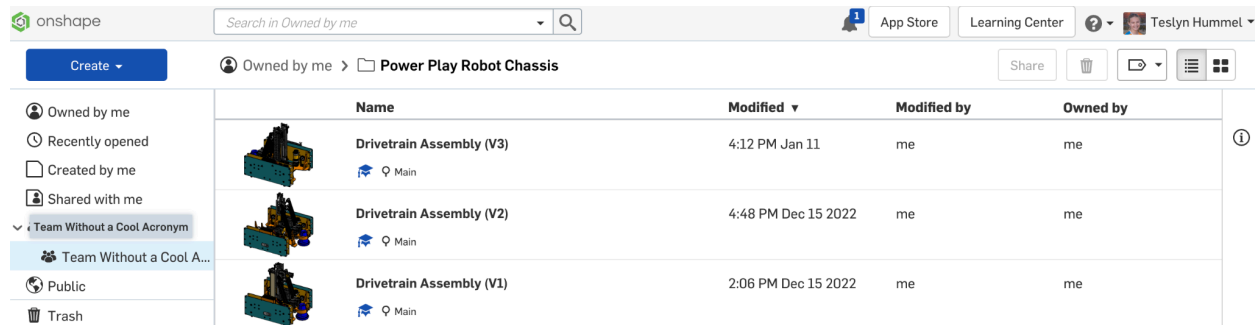
**Adobe Illustrator (above)** is what TWCA uses to make logos, pie charts, graphs, infographics and other visual design elements that are put into the engineering PORTFOLIO. The flowchart above was created in Adobe Illustrator and was then imported into InDesign. If changes are made to the Illustrator file, the linked InDesign visual will automatically update.

**Adobe InDesign (right)** is what TWCA uses to organize their PORTFOLIO into a 16 page layout using text boxes and image frames. These programs are designed to seamlessly work together. Oftentimes, TWCA will have the two programs open side by side so that elements can be copied and pasted from one to the other.

*Team Without a Cool Acronym's 2023-2024 CENTERSTAGE Engineering Portfolio*

### Onshape CAD Renderings:

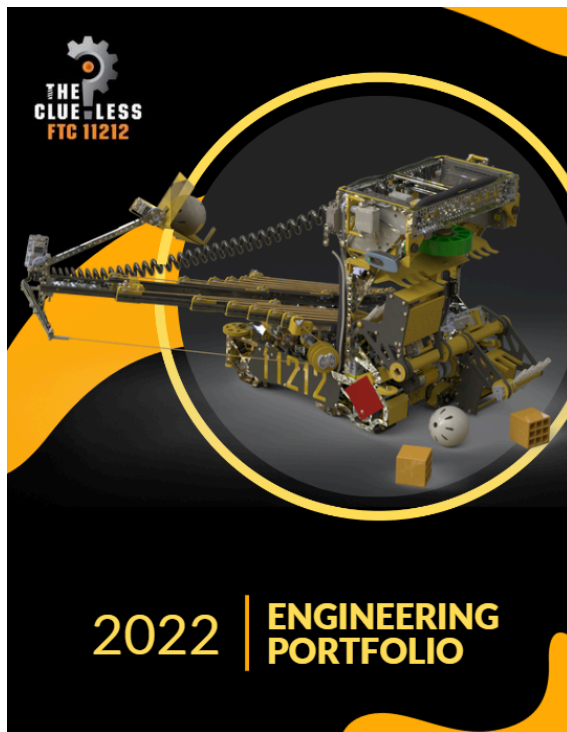
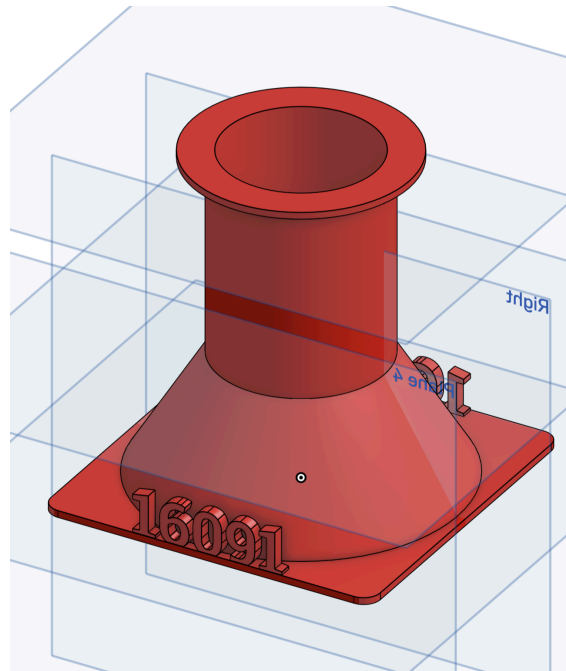
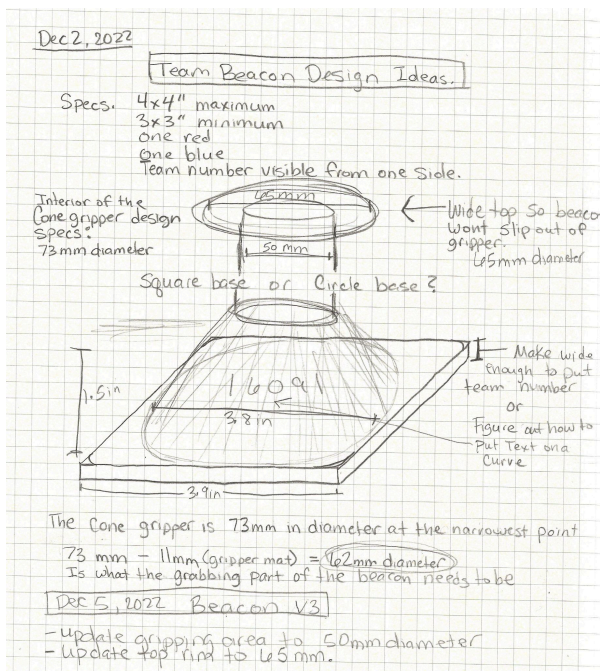
Technical drawings are a required element of your Engineering PORTFOLIO if you want to be eligible for many awards including the Think and Inspire Awards. They are recommended as support for other awards such as Innovate and Design. If your team does not use CAD software to make technical drawings, this is OK because it is not required to use software. It would be helpful however, to include hand drawn sketches that show how you thought about the look and dimensions of what you are creating. **16091 TWCA** uses a combination of hand drawn sketches and CAD renders from Onshape.



Many teams use Onshape because it is free to students and is easy for team members to work on drawings from their own homes and collaborate together using the “teams” feature.

Many teams will create realistic looking renders of their robot for their PORTFOLIOS but TWCA opts for a more cartoonish look to match their team brand. Below is an example of how TWCA uses both hand drawn sketches and CAD renders to show their design process, both of which are included in their Engineering PORTFOLIO:



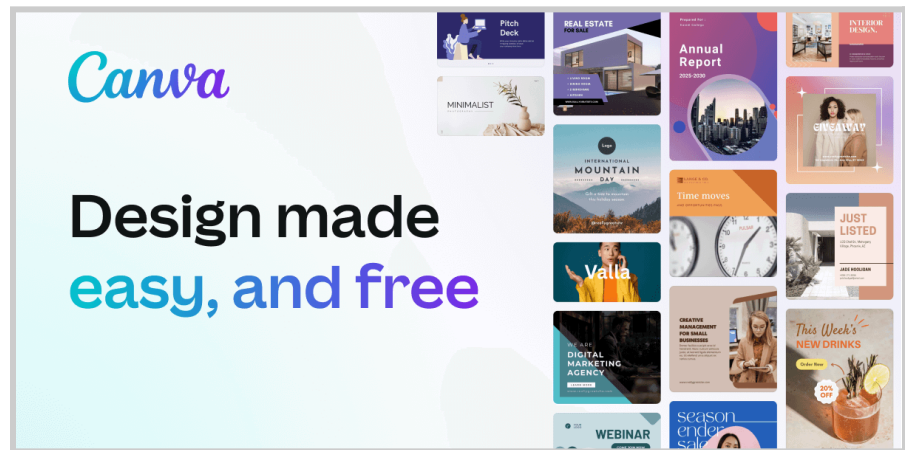


### **11212 The Clueless - Canva & Solidworks:**

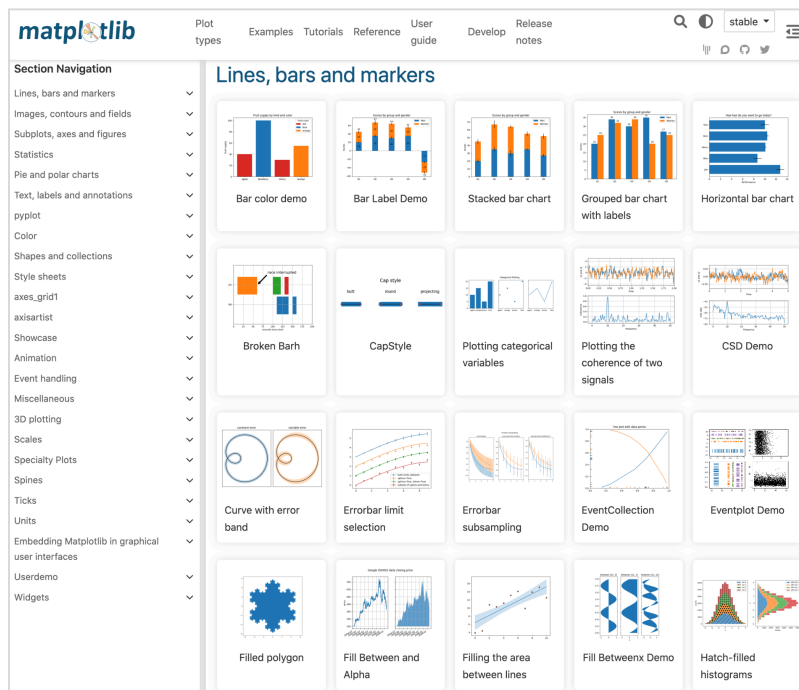
The Clueless uses Canva because of its easy collaboration features and aesthetic design elements. First their team begins by spending roughly one week developing the aesthetic for all 16 pages of the engineering PORTFOLIO. Canva's wide variety of design elements and ease of collaboration allows them to communicate with one another and constantly iterate the design until they reach a template that the whole team is satisfied with. Next they spend roughly 1-2 weeks planning out each page/section of the PORTFOLIO and make sure that they specify the type of images, verbal usage, and target award that they are striving to receive from that page/section. After each team member completes their assigned page, they meet up again and immediately begin discussing improvements prior to working on the next iteration. This process is repeated roughly 2-3 times, making changes to

images and text to make the pages more concise and coherent. Additionally, a critical part of the design elements they use derive from CAD renders. Their CAD team utilizes SOLIDWORKS Simulation in order to develop high quality renders of each primary subsystem (i.e drivetrain, intake, end-effector, etc.).

By going to [canva.com/free/](https://canva.com/free/) you can create an account and design your PORTFOLIO by customizing thousands of free templates. After getting the hang of the software, your team will be ready to create their own unique templates by using Canva's drag and drop editor. Another



bonus of using Canva is that you have the power to make charts, graphics and perform photo edits without needing special training with professional graphic design tools.



**Matplotlib.org** contains a user guide and offers tutorials to cover the basics of creating visualizations and demonstrates the best practices in using the package effectively.

Using charts and graphs can help your chances in every award category, but using them for your technical awards can be very useful in showing judges that you used real engineering techniques to plan, build and program your robot using data and statistics instead of slapping something together and hoping that it works!

## 19458 Equilibrium.exe - Canva, LaTeX, Google Sheets, Google Drawing

Equilibrium.exe uses Canva primarily for their engineering PORTFOLIO. For their aesthetic, they choose a color scheme that corresponds to their team colors of blue and pink. They like to use 10 point fonts so they can show a lot of information to the judges. They also make sure to use black text on light backgrounds and white text on darker backgrounds to maximize contrast making it easier to read

Equilibrium.exe, along with many other FTC Teams like to use dark backgrounds (like black) for their engineering PORTFOLIOS. Engineering PORTFOLIOS with black backgrounds can be very pleasing to the eye, but make sure you have a plan in place for printing your PORTFOLIOS. Most competitions require you to turn in a printed Engineering PORTFOLIO. Many Teams will use a professional printer to print a high quality borderless print. If your team must print at home, take your self printing capabilities into consideration and make sure you have premium paper and lots of ink included in your team budget!

Equilibrium.exe 19458					
Our Game Strategy and Goals					
<b>Deciding Game Strategy</b> We made a chart which included difficulty levels. Then, calculated tasks with repetitiveness, and probabilities that could occur at competitions. We would list all the possible scoring methods in each period and rank each period's difficulty level based on the options. To do this, we enter how many times you can score doing a task (number), and multiply it by points in order to get total. Finally, divide the total by the difficulty level to get the strategic value.					
<b>IRobot Design Decisions Based On Strategy</b> <ul style="list-style-type: none"> <li>• Smaller drivetrain dimensions to be able to navigate through field quickly</li> <li>• Develop a consistent detection algorithm for parking during autonomous</li> <li>• Design a lift mechanism that can consistently score on multiple heights</li> </ul>					
Task	Points	Number	Total	Difficulty Value	Notes
<b>Auto</b>					
Park Substation	2	1	2	1.0	
Park in Terminal	2	1	2	1.0	
Park Default Signal Zone	10	1	10	4.25	
Park Sleeve Signal Zone	20	1	20	6.7	must do
Cones in Terminal	1	6	6	5.12	
Cones on Ground Junction	2	6	12	8.15	
Cones on Low Junction	3	6	18	6.30	
Cones on Mid Junction	4	6	24	7.34	must do
Cones on High Junction	5	6	30	9.33	nice to have
Task	Points	Number	Total	Difficulty Value	Notes
<b>Teleop</b>					
Cones in Terminal	1	15	15	1.50	
Cones on Ground Junction	2	15	30	4.75	
Cones on Low Junction	3	15	45	22.5	must do
Cones on Mid Junction	4	15	60	32.0	must do
Cones on High Junction	5	15	75	51.0	nice to have
Task	Points	Number	Total	Difficulty Value	Notes
<b>Endgame</b>					
Junction Owned Cone	3	6	18	6.0	must do
Junction Owned Beacon	10	1	10	5.0	must do
Completed Circuit	20	1	20	5.0	nice to have
Park Terminal	2	1	2	1.0	
December	32, 3 cones	67	28	127	
January	45	70	32	147	

**Autonomous Breakdown**

- Use April Tags for consistent detection of parking location during autonomous
- Use limit switch to detect when we've obtained a cone
- Use odometry and roadrunner library to navigate the field autonomously

**Tele - Op Breakdown**

- Continuously stack on junctions at different heights
- Design a robot to be flexible to score on different rows easily
- Ability to drop cones in different areas without having to move the robot
- Use limit switch to detect when the claw has latched onto a cone
- Color sensor and LEDs added to ensure correct cone pick-up and notify the driver that a cone is in possession

**End-Game Breakdown**

- Own 6 junctions (preferably on our side)
- Own a junction with our custom beacon
- Own the right junctions for circuit completion

Score Totals

## 11770 Curiosity Robotics - Google Docs/Slides, OnShape and Canva:

Team Curiosity 11770 primarily uses Google Slides to create their engineering PORTFOLIO, with Google Docs/Photos, OnShape, and Canva used to create supporting elements. One way they like to make sure their PORTFOLIO is **cohesive** is creating a template page with **specific elements, colors, fonts and more**. They use this page as a format guide for the entire PORTFOLIO. In terms of color scheme, they generally stick to their team colors and accents (shades of red, orange, and yellows with some grey and black). They aim to use similar colors for similar things to highlight certain aspects and help create a cohesive theme across the PORTFOLIO. With this in mind, they designate consistent fonts and sizes for different text styles (headings, subheadings, body text) and utilize **selective bolding** to help make certain things stand out to judges. The smallest font they use is size 10pt, and most of their headings are in the 20-30 pt range. They strongly recommend shying away from large paragraphs or blocks of text in favor of making information readable, easy to access, and aesthetically pleasing.

**OVERALL ROBOT CONCEPT - 10/22**

**ROBOT OVERVIEW**

Our robot is composed of seven subsystems: drivetrain, intake, lift, drone, localization, scoring, and hanging. This year, we prioritized **modularity**, which allows each mechanism to be easily removed from the robot and facilitate quick mechanism-specific iteration. In hopes of maximizing our compatibility with allied teams, our robot is built to accommodate 3 main scoring strategies.

- ★ **Mosaics**
- ★ **Driver Automation**
- ★ **Speed Cycling**

Unlike previous years, our robot is only 12 inches wide to facilitate quick movement under and between rigging. Additionally, our robot makes efficient use of intelligent control to facilitate ease of driver control.

**FULL ROBOT CAD April 2024**

**JOURNEY OF THE PIXEL**

- 1 **Intaking Pixels** - After driving into a pixel, the intake pulls it up into the mechanism with a series of compliant wheels and custom built spikes. The pixel goes up a ramp that leads into our scoring mechanism, a box, that houses hooks that go down and catch the pixels and hold them in place.
- 2 **Cycling Paths** - After picking up a pixel, our robot drives towards the backdrop. We can traverse under both the rigging and the door, which allows us to switch strategies based off of where we are picking up pixels from and the strategies our alliance partners are most comfortable with.
- 3 **Score & Repeat** - The reliability and versatility of our intake enables us to effectively build mosaics by placing two pixels at a time on the backdrop. The lift then goes out, and the box goes out with a pivot. To align with the backdrop and score. Additionally, the box can turn 90° for ideal pixel placement.
- 4 **Endgame** - During endgame, our drivers change the angle of our drone launcher, which has been stowed to keep our robot short. There is a mounting servo that has a set angle ideal for launch. As the match comes to a close, we use CNCed hooks, mounted on our lift, in order to support the weight of our bot. The durability of the metal hooks allows us to consistently hang on the truss in endgame.

**Curiosity is Crazy about CADing!**

Our team spends an extensive amount of time designing and refining our mechanisms on Onshape. In fact, this season we've spent over 460 hours modeling! In that time, we've also created 146 versions across 6 documents.

Document name	Modeling Time (hrs)
Lift	97.2
Intake	70.13
Full Bot	72.31
Drivetrain	84.36
Scoring	79.9
Drone	66.5
Total	460

Curiosity utilizes dark backgrounds for their title pages, but they stick to white backgrounds for all of their main pages to keep ink prices down and allow their text/highlighted blocks to jump out a little more. Feel free to use dark backgrounds to support your aesthetic, but keep in mind that printing can get more expensive with more ink. Additionally, it can be tempting to go all the way up to the margin to maximize how much information you can fit, but keep in mind that this will require you to print slightly bigger than the allowed paper size. **Therefore, have a plan in place to create a high-quality, borderless print.** Our team printed on large sheets of paper and then used a paper cutter to trim off borders.

### Some more format/overall tips:

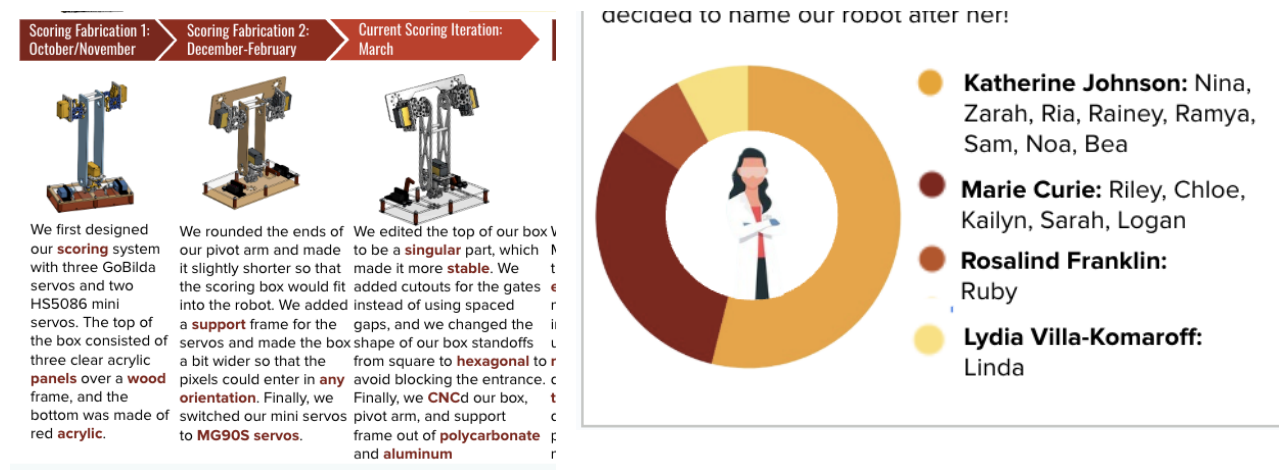
- Utilize all your whitespace—your team has done **SO** much work this season, so don't be afraid to include all the details!
  - On the other hand, if you are struggling to fit everything, focus on what's really important and how you can group things together. For example, if you have a relatively basic mecanum drive, maybe you only need a bit of a page to discuss that and can devote more space to a unique mechanism. Or, if you have



completed multiple outreach events at elementary schools, group that together in your PORTFOLIO and elaborate during judging!

- Make good use of your title page—Curiosity includes their mission statement and table of contents there!
- Keep structure in mind — how does the story of your season flow? It's important to share a cohesive, clear narrative with the judges. How can you introduce big ideas, such as the overall robot concept or troubleshooting, and then break them down and explain the specifics behind them? Bridge connections between pages to create cohesive themes about your team, but also be careful to not repeat yourself. Every sentence, image, and graphic should have a deliberate reason for why it's included (or why it was omitted).

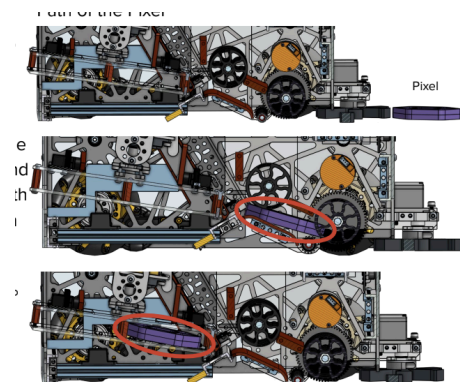
## Graphics/Images/Specifics



If Curiosity could suggest one thing, it's to **use graphics and images more than any text**.

Graphics are easier to understand and more memorable than text, as well as making the PORTFOLIO easier to read. They use Google Slides for almost all of their graphics (arrows, text boxes/highlights, field maps, flow charts, numbers, timelines, and graphs). They also use Canva occasionally, mostly for any smaller design elements or graphics. Infographics can be a great resource—they help demonstrate your impact in a very tangible way, and numbers are super memorable. Oftentimes, they show more than what a paragraph ever could, and also encourage the judges to stop by your pit to learn more! They use Canva minimally, mostly for any smaller design elements or graphics.

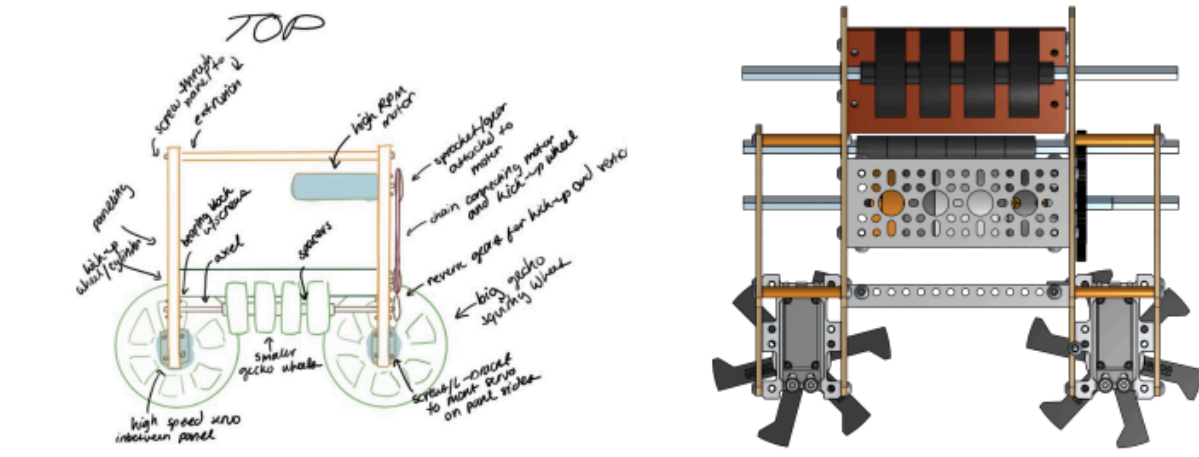
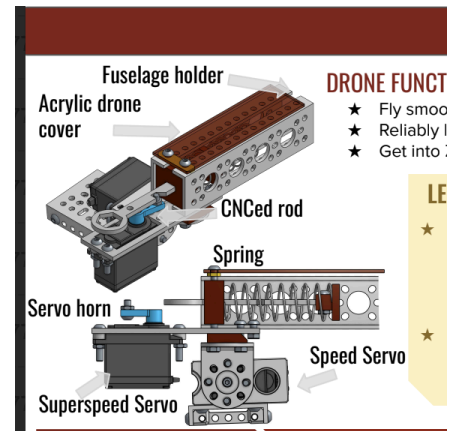
For **technical drawings**, Curiosity uses OnShape, where all of their CAD is done. Make sure your CAD models match the real life robot as much as possible (appearance of parts too!) and the views across different renderings are **consistent and highlight the mechanism**. All of their larger renderings are taken in isometric view, and mechanisms are rendered at the view that showcases them the most. Also, they recommend using **cross-section**



**views** to help highlight parts of the robot that may be blocked by paneling. Include game elements for the systems that interact with them (ie. if you're talking about your intake, showing the scoring mechanism interacting with the game element).

Additionally, make sure to explain your CAD! Use arrows to highlight specific parts, and showcase how the motion works. Check the picture on the right for an example of this.

Curiosity's biggest tip is to **document your work throughout the season**. Curiosity does this by keeping an engineering notebook, or a running google document that keeps track of all the work they do at practice. They also keep documents tracking outreach, meet debriefs, and almost everything they do. They have dedicated places where they save sketches and pictures, so when PORTFOLIO time comes, they have everything they need to highlight their design process and iteration throughout the season. Check out the picture below for an example on how they showcase iteration and our design process through **intensive and purposeful documentation**.



## Section 4: Organizing Your Portfolio by Award Requirements

Many teams organize their PORTFOLIO by award to make it easier for judges to find the information they are looking for. In a FTC competition, judges will often be assigned to one specific award category. If they have to look through the entire 15 pages to pick out the bits and pieces that are requirements for their award area, their job becomes very difficult to pick the best team.

In the following pages, you will find every award category with their award requirements and recommendations taken from the 2025 - 2026 FIRST Tech Challenge DECODE Competition Manual. Award requirements will vary from season to season, so it is always important to consult the Competition Manual of your specific game season as they may have changed.

## Think Award

### Removing engineering obstacles through creative thinking.

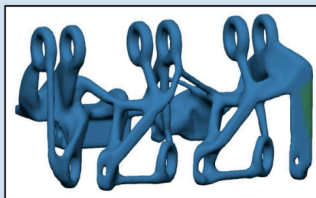
This judged award is given to the team that best reflects the journey the team took as they experienced their season. The content within the PORTFOLIO is the key reference for JUDGES to help identify the most deserving team. The team could share or provide additional detailed information that is helpful for the JUDGES. (DECODE Competition Manual Section 6.3.2, pg 41)

Think Award Criteria		
Required	1	Team must submit a PORTFOLIO. The PORTFOLIO must include engineering content which includes at least one of the following: A. evidence of use of the engineering process, B. lessons learned, and implemented related to the design of their ROBOT, C. trade off analysis /cost benefit analysis, and/or D. mathematical analysis used to make design decisions
Encouraged	2	Team PORTFOLIO may include information about resources which includes any number of the following examples: A. how the team learns from team mentors, and/or a development plan for team members to learn new skills, B. how the team recruited new people into FIRST, and/or C. how the team identified goals and tracked progress towards their goals throughout the season.
Encouraged	3	PORTFOLIO information is organized in a clear and intuitive manner

The Think Award is the award given to the team that judges consider the best at documenting the engineering process. This means Teams have a detailed PORTFOLIO containing engineering content and are able to supply supplemental documentation if asked in the team pits during interviews.

Beyond being well organized and aesthetically pleasing, Teams must have good engineering content which can be displayed as math equations, graphs and tables. Many Teams use Matplotlib.org to create these visuals, which may be confusing to use at first but the website contains a user guide and tutorials to cover the basics.

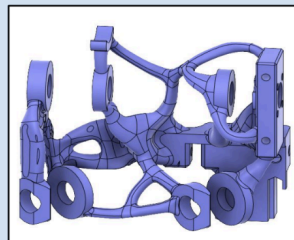
#### Iteration 2:



##### Key updates:

- Thinner profile uses less plastic
  - More connection points
- Areas for improvement:**
- Make holes bigger for threaded inserts
  - Add more tolerance to hub mount for Spintake
  - Bigger screw holes
  - Belt clearance

#### Iteration 7: (current)



##### Key updates:

- Reduced the number of brushes to accommodate for space, reduce breakage
- Motor held to one side, series of belts and pulleys allow the single motor to power both sides.
- Addressed all areas for improvement from previous iterations



Although an Engineering PORTFOLIO isn't required for the Design or Innovate Awards, make sure your team includes the engineering process with technical drawings to be eligible for the Think and Inspire Awards.

Because of space limitations, it isn't recommended to show every iteration of every design in the PORTFOLIO. Instead, show early and final designs to show judges the progress that has been made along with lessons learned. Additional iterations can be recorded in an engineering notebook, on a poster, or other forms of visual storytelling that is kept in your team's pits.

Team Without a Cool Acronym - 18091 - Centerstage
Engineering Portfolio

## Vertical 4-Stage Lift

**What's so Innovative?** After noticing that all teams were mounting linear slides at 30 degrees, we decided to mount ours vertically. This allows us to balance our robot and more reliably hang without risking damage to our slide system. This system doesn't allow us to stack pixels high, but aligns with our goal of stacking low and wide while building mosaics.

**Linear Slide Numbers:**

goBILDA 60 RPM Motor	120mm Pulley Rotation
*One rotation per second*	Full Extension = 696mm
Stall Torque = 1850oz-in	Truss Extension Height = 330mm
	Robot Weight = 27 lbs

330mm/120mm = 2.75  
seconds to extend high enough to hang on the truss.

**Problems: Electrostatic**  
Potential source for ESD events: An electrical engineer noticed that a **significant amount of static built up** in the slides because of its closeness to the ground.

**goBILDA Timing Belt clamps:**  
All of our goBILDA timing belt clamps broke. Through our research online, we saw that this was a common problem. We 3D printed our own clamps with 100% infill and have experienced zero breaks over 2 qualifiers.

**Solutions:** Under advisement of our electrical engineer mentor, we added 2 **grounding straps** from each side of the slide and ran one to the control hub and the other to the expansion hub. We also put **ferrite chokes** on all motor wires.

**60 RPM Lift Motor Pros and Cons:**  
**PRO:** Our choice of a lift motor with a lot of torque means we can hang very easily. **CON:** When we need to reset the lift after a match without power, there is so much torque that the timing belt must very noisily slip back into place.








11.

**TRANSFER**
Potential Energy #19706, Page 10

The purpose of the Transfer is to quickly move Pixels from the Intake to the Delivery.

**Transfer, profile view**

**Game Strategies Addressed:**

- Carry 2 Pixels at a time (but not more)
- Transfer can run as robot is driving (lowers cycle time)

**Transfer (EN-122)** has 14 custom pieces, 3 servos, 2 sensors

2 color sensors to detect Pixel colors

**MODIFIED GECKO COMPLIANT WHEEL (gray)**  
Pulls Pixels from Intake into Spatula. Can serve as a backup Intake. Powered by servo that is connected by chain.

Intake deposits Pixel here



Path of the Spatula (red dotted line)

Delivery goes here (page 11)

**SHIELD (blue, attached to Delivery)**  
Prevents Pixels from falling out the top of the Spatula as the Spatula is moving.

2 servos lift the Spatula

**SPATULA (black)**  
Transports 2 Pixels at a time from the Intake to the Delivery. If a 3rd Pixel enters the Spatula, one falls out and onto the floor.

Chassis attachment point

**QUALIFIER 1 TRANSFER**



**Key Features:**

- 2 distinct parts: horizontal compliant wheels (which move Pixels from Intake to Spatula), and Spatula (which flips Pixels into Delivery). Each part went through many iterations.
- Picks up Pixels even if rotated.
- Connection point to the Chassis is designed by AJ
- Large space to store 2 Pixels (extra Pixels fall out the top onto the floor)
- 1-way door blocks Pixels from falling out once they enter
- Mounting points for color sensors

**Areas for Improvement:**

- Cannot pick up from Pixel stacks because of the 1-way door
- Pixels fly upward and get stuck on top of the Spatula

**QUALIFIER 2 TRANSFER**



**Key Updates:**

- Combined Spatula and wheels into a single assembly
- Switched to vertical compliant wheels after meeting with Corey Knutson (see page 3)
- We promoted modularity by:
  - Attaching the compliant wheels to the robot with removable, easy-to-reprint arms instead of printing it all as one piece
  - Using chain to drive the wheels, not belts, because of chain's variable length (chain not pictured here)

**Areas for Improvement:**

- Transfer assembly is too wide and interferes with the Intake brushes
- Pixels get caught on the Spatula lip

**WORLDS TRANSFER (current)**



**Key Features:**

- Color sensors display Pixel color on LEDs
- Body is printed in black PETG to aid Pixel color sensors and improve strength
- Switched to a modified Gecko wheel after our design review with Infinity Robotics to help Pixels pass over the Spatula lip
- Width of the Spatula was reduced to stop interference with Intake. Idler sprockets were implemented to facilitate this.
- Spatula lip was curved downwards to better allow Pixels to pass over it

In order to ensure that we had enough torque to lift the Spatula before printing, we performed torque calculations for each iteration while they were still in CAD. See EN-167 for this math.

**Spatula Prototype 1**



**Spatula Prototype 2**



We prototyped the Spatula to experiment with curvature and filament type. We tried printing in PLA, flexible PLA, ABS, TPU, PETG, and PETG-CF. We chose PETG because of its good impact strength, low cost, and good layer adhesion. Pixels fell off our prototypes easily, so we installed a roof and a 1-way door.

## Connect Award Requirements & Layout Ideas

This judged award is given to the team that connects with their local science, technology, engineering, and math (STEM) community to learn and adopt new tools through effort and persistence. This team has a team plan and has identified steps to achieve their goals. **A PORTFOLIO is not required for this award.** (Competition Manual Section 6.3.2, V0 pg 41)

### Connect Award Criteria

Required	1	Team must describe, display, or document a team plan that covers all of the following: <ol style="list-style-type: none"> <li>The team's goals for the development of team member skills, and</li> <li>The steps the team has taken or will take to reach those goals.</li> </ol>
Encouraged	2	Provide examples of developing in person or virtual connections with individuals in the engineering, science, or technology community.
Encouraged	3	Provide examples of how it actively engages with the engineering community.

Team Without a Cool Acronym - 18091 - Power Play Engineering Portfolio

### Mentors and Professionals That Have Helped Us Along the Way:

Our team aggressively seeks out professionals to help educate us on the best way to reach our technical goals. We are able to do this by attending community STEM events where these professionals are present and tell them about our team to begin a relationship.

**RAM Aviation, Space & Defense**

- Gregg Robison, CEO of RAM** has been a big fan of our team for 3 years now. He presented our team and our Freight Frenzy season accomplishments at a STEM event at Dixie Technical College in St. George, UT. He has helped fund our team and provides us with engineers from his team to review our mechanical designs.
- James Wigton, Senior Mechanical Engineer** meets with us in person and virtually over Slack to review our mechanical design and offer support. He is seen in the bottom right photo helping us work out some issues with our linear slides.

**d.B Systems Inc.**

- Halley Bonfanti, CEO**, has provided us with engineers from her company to review our designs and provides us with access to industrial equipment. We were able to 3D print a custom pulley on their industrial size 3D printers 10" build plate.
- Jared Hummel, Director of Engineering**, provides us mostly with programming tutorials, programming review and help with troubleshooting. He sometimes will help us with obvious mechanical issues and help us brainstorm solutions.
- Washington County Commission**  
County Commissioners **Victor Iverson** and **Gil Almquist** met with our team where we talked about STEM in our community. We presented them with plaques to thank them for supporting our team and for their continued support.

6.

Mecha Knights 16028 Engineering Portfolio

### Mentors

#### New Mentors

**Jasmine:** FIRST FTC Alumni. She taught us how to better communicate with members of our community who are not familiar with FIRST. We have gained better recruitment skills from her.

**Shae:** FIRST FTC Alumni. He is a coding advisor. She has helped our team with building and making prototypes. We've learned idea refinement from her and she will be coming to the worlds championships with us.

**Eva:** FIRST FTC Alumni. She has helped our Outreach team with creating the portfolio and planning events. We have also learned about writing to officials from her.

**Katie-Boh:** She helps and advises Outreach team. We have learned how to fundraise and how to plan events with her help. She helped us with our time management skills. She also drives our team to competitions and events.

**Darcy:** She has taught our Outreach team about how to professionally write emails. We have also learned about editing, writing concisely, and how to communicate our messages well.

#### Sustained Mentors

**Michael Thompson:** Software Engineer Quest/Dell One Identity. He assists our programming team with understanding how and why our code works.

**Gwen Martin:** FRC Alumni. She came to help our team with Outreach, and everything non-technical. We have learned a lot from her. She's taught us how to simplify our process, formal writing, and taught us how to put together a sponsorship packet.

**Travis Anderson:** FTC Alumni. He came back as a mentor. We have learned better building practices and engineering fundamentals.

**Sarah Asay:** Seedseed Academy, Business Consultant, BA. She produces videos for small businesses. She assists our team by helping our members reach out to corporate sponsors. Additionally, she helps with website design, videography, and sponsor emails.

**Dr. Alvin Echeverria:** FPA Science Teacher and former FRC Coach, Doctorate in Education. We recruited him as an assessor/inspector for our FPA Qualifier. He helps us study and calculate the underlying science and math principles for our lift.

### Coaches

**Lafe Peavler:** Main coach and mentor for our team. He is our general advisor and assists us with all aspects of our team such as answering questions and giving us feedback. He manages our finances and time.

**Duncan Larson:** Coach and mentor for our team. He helps us with our prototyping and our robot design as well as the initial building process and prototyping.

9.

## Innovate Award Requirements

The Innovate Award celebrates a team that thinks imaginatively and has the ingenuity, creativity, and inventiveness to make their designs come to life. This judged award is given to the team that has an innovative and creative ROBOT design solution to any specific components in the FIRST Tech Challenge game. Elements of this award include elegant design, robustness, and 'out of the box' thinking related to design. This award may address the design of the whole ROBOT or of a sub-assembly attached to the ROBOT. The creative design element must work consistently, but a ROBOT does not have to work all the time during matches to be considered for this award. **A PORTFOLIO is not required for this award.** (DECODE Competition Manual Section 6.3.6, V0 pg 43)

Innovate Award Criteria		
Required	1	Team must describe, display, or document examples of the team's engineering content that illustrate how the team arrived at their design solution.
Required	2	ROBOT or ROBOT MECHANISM is creative and unique in its design.
Required	3	The innovative element must be stable, robust, and contribute positively to the team's game objectives most of the time.
Encouraged	4	Designs often come with risks, the team should discuss, describe, display or document how they mitigated that risk.

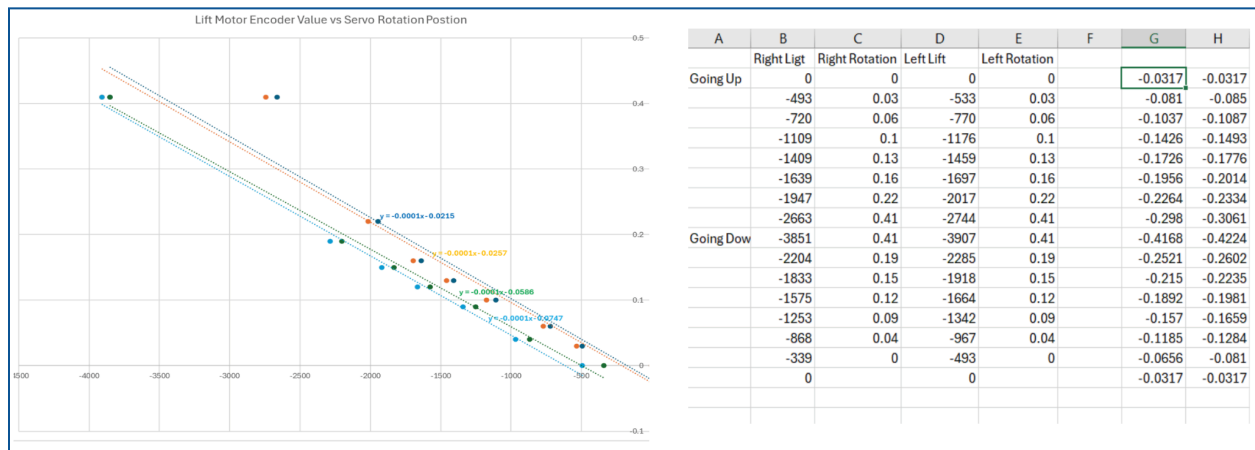
The Innovate Award and the Design Award are closely related and are often combined in the Engineering Portfolio.

## Control Award Requirements & Ideas

The Control Award celebrates a team that uses sensors and software to increase the ROBOT'S functionality during gameplay. This award is given to the team that demonstrates innovative thinking to solve game challenges such as autonomous operation, improving mechanical systems with intelligent control, or using sensors to achieve better results. The solution(s) should work consistently during MATCHES. Solutions considered for this award are not solely limited to the AUTO period of the MATCH and may also be used during the TELEOP period. The team's PORTFOLIO must contain a summary of the software, sensors, and mechanical control but would not include copies of the code itself. (DECODE Competition Manual Section 6.3.7, V0 pg 43)

Control Award Criteria		
Required	1	Team must submit a PORTFOLIO. The PORTFOLIO must include all of the following: A. hardware and/or software control components and systems on the ROBOT, B. which challenges each COMPONENT or system is intended to solve, and C. how does each COMPONENT or system work
Required	2	Team must use one or more hardware or software solutions to improve ROBOT functionality by using external feedback and control.
Encouraged	3	The control solution(s) should work consistently during most MATCHES.
Encouraged	4	Team could describe, display, or document how the solution should consider reliability either through demonstrated effectiveness or identification of how the solution could be improved
Encouraged	5	Use of the engineering process to develop the control solutions (sensors, hardware and/or algorithms) used on the ROBOT includes lessons learned.

Teams need to make sure they provide the required information for this award in their PORTFOLIO. This is a new requirement, as a separate Control Award form will not be submitted this season as was required in seasons past.



Above: 16091 TWCA gathered data points and calculated slope and y intercept to create a linear function. This enabled the robot to automatically rotate their intake arm to clear interior framing based on the height of their lift position. This chart paired with an explanation of how the software improved robot functionality by using external feedback meets a requirement of the Control Award.

## Reach Award Requirements

This award celebrates a team that has introduced and recruited new people into FIRST. Through their efforts, they have sparked others to embrace the FIRST culture. A PORTFOLIO is not required for this award. (DECODE Competition Manual Section 6.3.4, V0 pg 42)

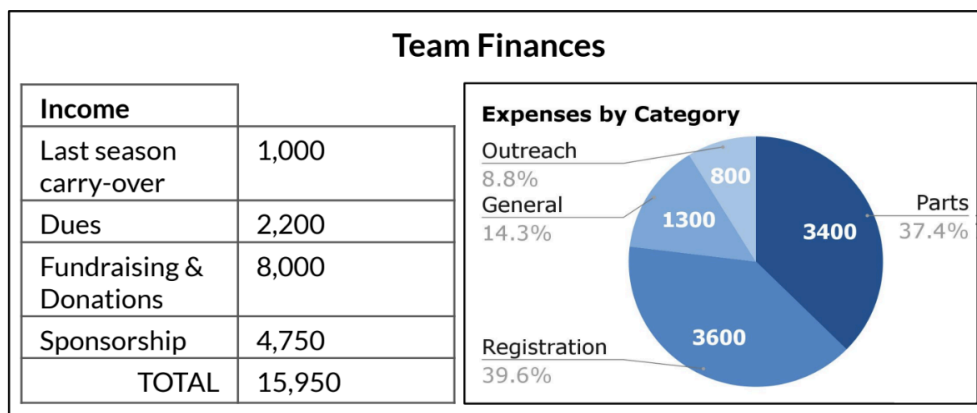
Reach Award Criteria		
Required	1	Team must discuss, describe, display, or document their outreach objectives and how their outreach activities support the FIRST community. (Team Update 03, 9/25/2025)
Required	2	Team must discuss, describe, display, or document their successful recruitment of new teams, or coaches, or mentors and/or volunteers who are not otherwise active within the FIRST community.
Encouraged	3	Is an ambassador for FIRST programs in a way that makes FIRST loud.
Encouraged	4	Has a creative and evolving approach to outreach materials that market their team and FIRST.

## Sustain Award Requirements & Ideas

Sustainability and planning are essential for a FIRST team, because they ensure the program's long-term success. This award celebrates the team that has considered their future team members and has worked to ensure that their team or program will continue to exist long after they have gone on to develop their careers. A PORTFOLIO is not required for this award. (DECODE Competition Manual Section 6.3.5, V0 pg 42)

Sustain Award Criteria		
Required	1	Team must discuss, describe, display, or document their plan(s) which includes at least one of the following: A. finances and financial sustainability plan, B. season project planning, and/or C. team sustainability plans and/or objectives.
Required	2	Team must discuss, describe, display or document how a team tracks their progress towards their plan(s) listed above.
Encouraged	3	Team has clear team roles for all members of the team and a process for developing leadership.
Encouraged	4	Team can discuss, describe, display, or document how they manage the team's constraints and/or risks.





Many Teams use spreadsheets, tables and graphs to document Sustain Award criteria. The goal in using these tools is to enable judges to identify if you meet award requirements within seconds. The table and pie graph to the left highlights **19706 Potential Energy's** financial prowess while the spreadsheet below tracks team member's outreach and service.

Outreach Type	Date	Event	# team members	Hours spent	Person-hours	Project Momentum?	JC	ST	AU	IH
Advocacy	4/27/2023	Meeting with MN State Rep Kelly Moller	3	0.25	0.75	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mentoring	5/2/2023	FLL Explore Meeting (Master Electronics)	2	1.5	3.00	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Mentoring	5/9/2023	FLL Explore Meeting (Master Electronics)	2	1.5	3.00	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Community	5/19/2023	Valentine Hills Carnival	5	4	20.00	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Volunteering	5/20/2023	FLL Explore Festival	3	3	9.00	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Community	5/29/2023	Cub Foods Fundraiser (Arden Hills)	7	6	42.00	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Advocacy	6/8/2023	Meeting with Rob Reetz	3	0.5	1.50	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Engineering	6/9/2023	Tour of Boston Scientific	6	2	12.00	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Engineering	6/21/2023	SPARCS Microsoft	4	1	4.00	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Engineering	6/27/2023	SPARCS Infinity Robotics	2	1.5	3.00	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mentoring	7/13/2023	Meeting with Jackie/Spon Con about MVHS FTC Club	3	1	3.00	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Community	7/17/2023	Shoreview Library Story Time	3	1.25	3.75	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

This season, Sustain criteria includes risk management planning. We discussed what this means with several FIRST Championship level judges and they all agreed that this could be described as a SWOT Analysis.

A SWOT analysis is a strategic planning tool that helps identify the strengths, weaknesses, opportunities and threats of a project. It is a popular tool for initiating conversation about addressing future challenges.

SWOT analysis can be helpful in evaluating your overall team performance in a competition setting or can be applied to smaller subteams, such as drive-team performance, scouting team procedures, build-team, etc.



## Design Award Requirements & Layout Ideas

The Design Award celebrates the team that demonstrates industrial design principles, striking a balance between form, function, and aesthetics. The design process used should result in a ROBOT which is durable, efficiently designed, and effectively addresses the game challenge. A PORTFOLIO is not required for this award. (DECODE Competition Manual Section 6.3.8, pg 44)

Design Award Criteria		
Required	1	A team must be able to describe or demonstrate how their ROBOT is elegant, efficient (simple/executable), and practical to maintain.
Required	2	The entire machine design, or the detailed process used to develop the design, is worthy of this recognition, and not just a single component.
Encouraged	3	The ROBOT distinguishes itself from others by its aesthetic and functional design.
Encouraged	4	The basis for the design is well considered (that is inspiration, function, etc.).
Encouraged	5	Design is effective and consistent with team game plan and event strategy.

CURIOSITY | 11770

8

DESIGN PROCESS III

SEEK FEEDBACK AND KEEP ITERATING

CNCING

This year, we CNCed the hooks out of aluminum for hanging, all of our drivetrain panels out of aluminum and polycarbonate, the intake panels, the pivot arms, the drone rod and mount, and top of the scoring box. As necessary, parts are CNCed for both aesthetic, durability, and to minimize weight. You can see the iteration of our hooks below.



Our first iteration was the one on the left, with progression moving left. We then rounded the edge of the wood so it wouldn't dent the truss. The last iteration is the CNCed version that is now on the robot, and it has never failed us!

ODOMETRY CODING BEGINS

Last year we used the premade localizer class from Rosdrunner but this year we decided to make our own localizer class for easier adaptations to the code specific to our robot. It's a coordinate based system that allows the robot to exactly where it is on the field at all times which allows us to have set positions for the robot to drive to.



TESTING AND REITERATING (OVER AND OVER)

We iterate and redesign throughout the design process. With a fully assembled robot, it's much easier to identify errors that could become large problems for us in the future. After completely creating the first iteration of our robot, we focused on small adjustments and additions. Since we manufacture our own parts, it is easy to iterate through these changes. Post it's, we CNCed our drivetrain panels, box top, intake panels, drone launcher, lift, pivot arms, and hooks to make them stronger and sturdier. This has prevented us from more stress fractures and breaks, given us more durable parts, and given us easier access to the robot.



LESSONS LEARNED

- ★ The design process works best when more people can participate
- ★ To make sure our robot is the best it can be, we need to fulfill specific game-related functional requirements
- ★ Quantitative analysis is really useful in determining what specific motors and servos to use
- ★ Simpler solutions are often better than more complicated solutions
- ★ Approaching ideas from multiple perspectives is the best way to improve

AUTOMATION

This season utilized varying automation tactics to make it easier for the drivers. This year we are using both touch and color sensors. The touch sensors allow for precision in the lift automation by stopping the lift motors from continuing to lower once the lift is at its lowest point. This helps prevent entanglement of the lift strings. The color sensors detect when a pixel has entered the box, after which the gates automatically close to hold the pixels in place, and the drivers are notified through the rumble function on their controllers. We also use cameras to scan the AprilTags, and the robot can automatically drive up to one of the three scoring positions on the backdrop.



WIRE MANAGEMENT

This year we utilized a slinky to encapsulate the lift and its related wires, which allows them to coil neatly and efficiently. This way the wires stay protected, out of the way damage, and without getting in the way of moving systems or motors.



PROBLEMS AND SOLUTIONS WITH THE DRONE

We faced varying problems with the drone throughout the season, the first being the drone would constantly fall off at Meet 0 and Meet 1, ending up crushed on the field. As a solution, we made a plate for the top of the drone to encapsulate the drone in a rectangular shaped box. The next problem we encountered was when the drone was inclined, the drone mount would block the lift from moving upwards. We combatted this by remounting the drone onto a new place on our side panels.





## Inspire Award

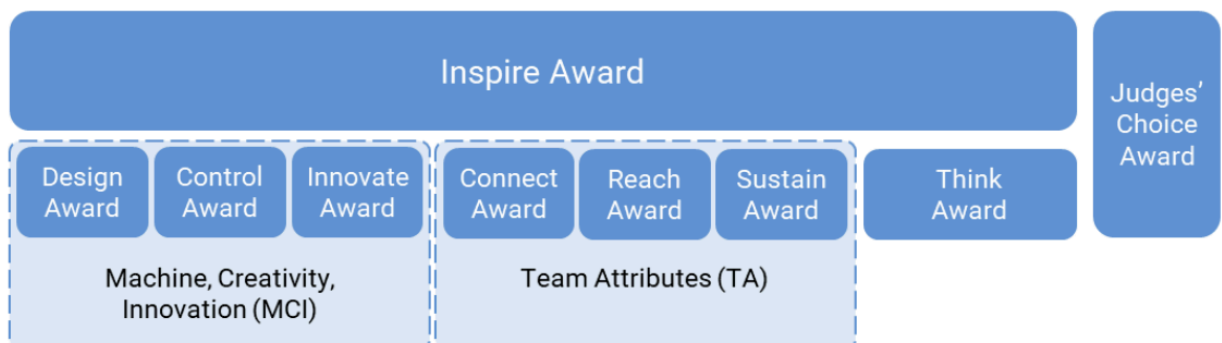
The team that receives this award is a strong ambassador for FIRST programs and a role model FIRST team. This team is a top contender for many other judged awards and is a gracious competitor.

The Inspire Award winner is an inspiration to other Teams, acting with Gracious Professionalism® both on and off the playing FIELD. This team shares their experiences, enthusiasm and knowledge with other Teams, sponsors, their community, and the JUDGES. Working as a unit, this team will have shown success in performing the task of designing and building a ROBOT. (DECODE Competition Manual Section 6.3.1, V0 pg 40)

Inspire Award Criteria		
Required	1	Team must submit a PORTFOLIO.
Required	2	The Inspire Award celebrates the strongest qualities of all the judged awards. A team must be a strong contender for at least one award in each of the following judged award categories: A. Machine, Creativity, and Innovation Awards, B. Team Attributes Awards, and C. Think Award
Required	3	Team must be positive and inclusive, and each team member contribute to the success of the team.
Required	4	Team is able to describe, demonstrate, document, or display their experiences and knowledge to the JUDGES.

**The Inspire Award recognizes Teams who excel in MCI, TA, and Think award accomplishments. This Team is an all-around inspiration for others**

Figure 6-1: Award hierarchy



- **MCI awards** recognize the technical accomplishments of Teams in the planning, design, construction, operation, and control of their ROBOTS.

- **TA awards** recognize teams who have expanded their skillset, created a plan to sustain their program and team, and spread the message of FIRST throughout their outreach.
- **The Think Award** recognizes Teams who masterfully document their team's process and product using their PORTFOLIO.

## Section 5: Finishing and Printing your Engineering Portfolio.

Now that your Engineering PORTFOLIO is finished, you need to make sure you get the PORTFOLIO in the hands of your judges! Instructions about when and how Teams should submit their PORTFOLIOS should be communicated by the event director before the event.

If you are handing in your PORTFOLIO in person, you will need to print your notebook. Teams have handed in everything from 16 single sided loose pages to double sided, professionally printed and bound pages.

TWCA likes to use 1/2" binders or plastic report covers with prongs and clear fronts for qualifiers, and will spring for professional printing and binding for region and world championships.



*A quick search at Amazon.com shows many results for plastic report covers.*

Congratulations! By reading through this resource, you should now be steps ahead of many Teams that you are competing with and will be ready to conquer your own team's Engineering PORTFOLIO!

If you are a team that has used this resource, the contributing Teams would love to hear your experience, and hear about any awards you earned at your next event! If Teams have any suggestions for additional information or edits we can make, we would love to hear from you so that we can make meaningful changes in our next update!

Please contact [teamwithoutacoolacronym@gmail.com](mailto:teamwithoutacoolacronym@gmail.com) to report your stories or suggest edits or changes. If any teams are interested in contributing content, please email highlighting your team's accomplishments and send a copy of your most recent sharable engineering PORTFOLIO.

Please check out our contributors websites at:

16091 - T.W.C.A. (Team Without a Cool Acronym) - <https://TWCArobotics.com>

11212 - The Clueless - <https://www.thecluelessftc.org/>

19458 Equilibrium.exe - <https://equilibrium19458.wixsite.com/equilibrium-exe-1945>

11770 Curiosity - <https://curiosity11770.marlborough.org/>

19706 Potential Energy - <https://www.potentialenergyftc.com/>

16028 Mecha Knights - [www.instagram.com/mechaknights16028/](http://www.instagram.com/mechaknights16028/)