Combustible Lemons
Team # 5466

Page Demonstrating Format

The Combustible Lemons	November 8, 2016
Goal 3: Our team will start an FRC team at Davenport West High School in order to incorporate more students in robotics while continuing to mentor teams in the other levels of FIRST.	**Start Time:** 3:15 PM **End Time:** 8:00 PM

Daily Summary

Design	Build	Program	Test	Outreach	Public Relations
-Armor Attachment -Sprockets -FLL Jr. Robot	-Capball Forklift -Servo Removal	-Autonomous Refining -Mecanum Wheel Program	-Driving Red and Blue -Autonomous	-Packaging Chromebooks	-Scouting Sheet -Notebook Pictures

Reflections | **Initials** | **Assorted Graphics**

Design:

Carolyn W- After I got a new chromebook, Noah taught me, Alexa, and Brandon Clark how to use the scouting sheet. Once I got done with that, me and Alexa continued on the armor. At first we had to cut part of the edge off of the armor so it won't be too long. Once we got the armor the right size and got all of the holes drilled for the screws, and attached the armor to the robot with only screws so far, not nuts to hold them in place. Somewhere in the time of us working, the Mortal Combots did a scrimmage against us.

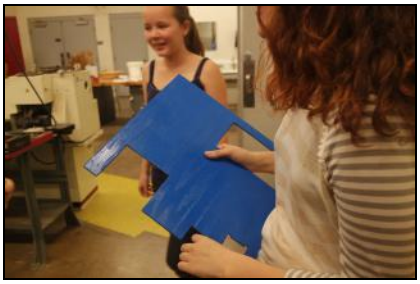
Alexa C- I got a new chromebook, learned how to scout, and talked game strategy before finishing the armor. I taught Carolyn how to use the drill press and she drilled most of the holes. Both sides of the armor have been mounted. Also, I taught Saul from the Combots "Armor Theory", so basically three different kinds of armor and their effects. The team and I watched the first scrimmage between us and the sister team. We won!

Jenna S- In CAD I finished the sprocket on the side to keep the chain in place. I then started working on getting the arms that will lift the cap ball onto the robot. I had to cut down an axel in CAD to fit the way it does on the robot. I then watched some robot test matches.

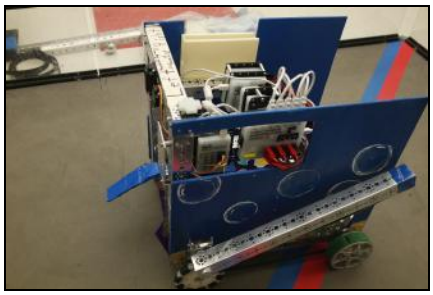
Cody N-B- I started by exchanging my chromebook for a not-broken, pretty one. Then, I started working with Jenna on CAD, and

Design:

Robot Armor In Workshop (Figure 68)

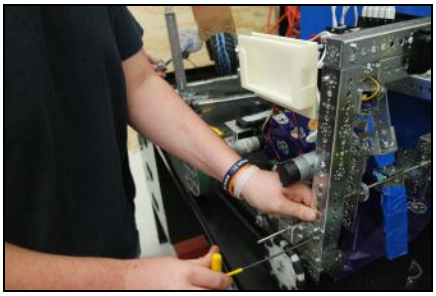


Robot Armor Attached (Figure 69)



Build:

Refining Capball Forklift (Figure 70)



FIRST Designer: Witness:

The Combustible Lemons	November 8, 2016
Goal 3: Our team will start an FRC team at Davenport West High School in order to incorporate more students in robotics while continuing to mentor teams in the other levels of FIRST.	**Start Time:** 3:15 PM **End Time:** 8:00 PM

Reflections	Initials	Assorted Graphics

learned a few new things about it that I hadn't learned in IED. I then started working again on the FLL Jr. robot and was able to get the Pull Robot working, mostly. Then, the polls starting coming in and I freaked out for a while, before getting back on task with the LEGO robot. I hope to build a different kind of robot next week and add a new kind of robot to my repertoire to teach the team next time we meet up.

Build:

Mason H- I spent the time building working with the current robot. I had to redo the set screws on the cap ball forklift. I then had to remove the second servo on the robot. This was replaced by a plate which is our new beacon presser. I finally concluded with collecting the bolts and nuts from the field and replacing them on the robot.

Program:

Noah D- I worked with Brandon R just a little bit in terms of strategizing for autonomous. We fortunately were able to get autonomous working on the phone so we were able to successfully switch to tele-op without our robot dying.

Brandon R- In autonomous, we made tweaks to the underlying code to make it cleaner and more efficient to run. We did this by removing unnecessary loops, variables, classes, and more. Another important thing we did was fix the stop button in autonomous! After looking at the forums for other teams who had this issue, we found that it was pretty common. After inserting an *opModeIsActive()* check into the while loops we were using to check various things in our autonomous code, the OpMode was able to stop when requested to.

Refining 3D Printed Phone Case (Figure 71)

Mecanum Chassis Progression (Figure 72)

Program:

Programming Autonomous (Figure 73)

Test:

Drive Practice (Figure 74)

FIRST Designer: Witness:

The Combustible Lemons	November 8, 2016
Goal 3: Our team will start an FRC team at Davenport West High School in order to incorporate more students in robotics while continuing to mentor teams in the other levels of FIRST.	**Start Time:** 3:15 PM **End Time:** 8:00 PM

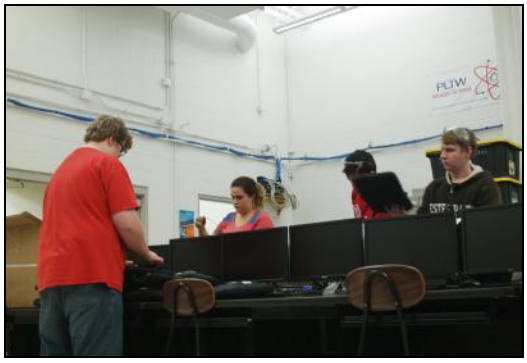
Reflections	Initials	Assorted Graphics

Alyssa R- I started off by checking off the electrical part of our inspection sheet. Then I moved on to working on the autonomous code. This was just making a few tweaks to perfect the code.
Chance C- I went to the library to get a chromebook at the beginning. After our meeting, I helped Brandon R test red autonomous, and most of the time it worked. Then Brandon S wanted me to make and print a doc that tells the status of a battery. I made it as big as possible while bolded because that's what he wanted. Then I continued to help Brandon R with autonomous because the builders will be putting on mecanum wheels, so we have to program that, using 4 motors, however, it will allow for new possibilities.
Test:
Alyssa R- We ran quite a few autonomous tests. Over half of them were successes. Which is great for us! After autonomous we let the drivers drive the TeleOp portion of the game. We had a small scrimmage against the Mortal Combots, and we ended up winning that as well. It was a great day for the Lemons as far as running the robot goes.
Brandon R- Autonomous tests were ran today, and I found the results spectacular! A total of 15 tests have been ran so far, and 12 have succeeded. The main problem with our autonomous that we observed today was the turning being inaccurate, sometimes going over and other times coming too short.
Noah D- We ran a lot of testing today in continuation of our preparation for our league meet this saturday. I created a google sheets for us to record the results of our test matches throughout the season. We are now up to 10

Autonomous Testing (Figure 75)

Outreach:

Chromebook Sorting (Figure 76)



Mentor Interaction: X
Public Relations:

Scouting Sheet Lesson (Figure 77)

FIRST Designer: Witness:

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Reflections	Initials	Assorted Graphics

matches and we are averaging 59 points. We also ran a scrimmage with the mortal combots so we could help each other prepare match strategy for the upcoming league meet.
Brandon S- Mason, Noah, and I worked as a driver team in a scrimmage and various other practice matches. We scored 69 points on average, not including one time where we picked up a blue ball, and because it was a practice match we treated it as a 40 pt major penalty. We can now score all beacons in teleop, score 20 pts in autonomous, and score particles in the corner vortex.
Mason H- In the testing aspect of the day, I drove the robot multiple. We did multiple tests on the red side of the field, with autonomous failing only 2 times out of 15. Our highest score was totaled at 69 points. Our design also should note, that using the ramp for the cap ball forklift is much more effective than trying to lift the ball via the wall for support. I did make a failure, by picking up the opponent's particle. At an overall view though, this mistake was made in only one of our dozens of tests.
Kailey F- I worked with Mason, Noah, and Brandon S to do practice matches. We ran 5-6 matches. I recorded most of them in our practice matches spreadsheet.
Outreach:
George M- After the meeting, I volunteered to help with bagging and taking the chromebooks to the library. Michael and I were assigned to start packing for the competition. It was difficult mostly because most of the things that were necessary to be packed were being used by the Combots or our own teammates. Nevertheless, we packed whatever was available of what we needed.

FIRST Designer:

Witness:

The Combustible Lemons	November 8, 2016
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Reflections	Initials	Assorted Graphics

Michael F- I started off today by putting away the chrome books, and then I wandered around counting different things for the pack up chart.

Mentor Interaction:

Brandon C- I began work on the mecanum wheels. I discussed our plan with Mr. Dubberke, and we decided to power each wheel with chain. I began work on them, but then ran out of time.

Public Relations:

Kane G- I started off the meeting by taking notebook pictures and took video of our first scrimmage with our sister team the mortal combots. Then I took more pictures and helped with whatever was needed, then coach Smith helped me become a volunteer with *FIRST.*

Kailey F- Since I am scouting at competition, I learned more in depthly how to work with the scouting algorithm. We all are getting individual chromebooks through the school, so we are using those at competition for the algorithm.

Brandon C- To begin this meeting, I got together with Kailey, Noah, Carolyn, and Alexa to learn how to effectively use the scouting sheet. After this, I started to finish up on some outreach notebook pages.

FIRST Designer:

Witness:

Combustible Lemons
Team # 5466

Steps of Engineering: Defining the Problem

The Combustible Lemons	September 27, 2016
Goal 1: We want to take our knowledge gained from FIRST to Kenya in order to teach Kenyan youth the problem-solving skills they need to impact their daily lives.	Team Norms

1. **Code of Conduct**
    a. Each team member will share the same amount of work and responsibilities
    b. No foul language
    c. No excessive use of phones.
    d. All members will find work to do if they don't have any at the moment
    e. Reasonable dinner time (30 minutes suggested)
    f. All members must complete their engineering notebook entry for each meeting within 24 hours of the meeting.
    g. Be on time (3:15 PM for Tuesday meetings, 8:00 AM for Saturday meetings)
    h. 75% attendance required to go to competition

2. **Standard Communication Methods**
    Primary contact method: Email
    Secondary: Facebook Messenger
    Tertiary: Phones (Texting)

3. **Frequency of Communication**
    a. After school
    b. At home online
    c. All team messages will be emailed and posted to groupme. All members are expected to check communication systems at least once every day.

4. **Decision making policy:**
    Small decisions (minor change to the robot) - do and document in engineering notebook
    Medium decisions (alter sub-assembly of the robot) - discuss with several members
    Large decisions (major change to the robot) - discuss with entire team

5. **Process for Making Design Decisions**
    a. Brainstorm together
    b. Decision matrices and constraints

6. **Process for Dealing with Conflict**
    a. Don't leave
    b. Discussion with all affected
    c. Bring in other team members
    d. Bring in coach or mentor

FIRST® Designer: Witness:

Combustible Lemons
Team # 5466

Steps of Engineering: Creating Concepts

The Combustible Lemons	September 29, 2016
Goal 2: We want to have a robot that is competitive in both scoring capability and design.	**Start Time:** 3:15 PM **End Time:** 8:00 PM

Daily Summary

Design	Build	Program	Test	Outreach	Public Relations
-Brainstorm -Designed Robot Chassis -Begun work on CAD	-Build 2 chassis -Prototype scoring mechanism -Build remainder of field	-Teach Basic Programming	X	-Oct 10th Board Meeting -Oct 15th Drive-In Demo	-Robotics Video

Reflections | **Initials** | **Assorted Graphics**

Design:

Brandon S- We divided into groups, and Michael, Noah, and I started designing and constructing a prototype version of an end effector. The design included a hollow rectangular prism with a motor that has 2 inch flaps. The motor with flaps allows for the balls to be scooped into the prism for storage. Then, once up to 4 particles are stored, launch them out at a velocity high enough to go into the corner vortex.

Jenna S- The meeting started with a brainstorm about our chassis, and how we should pick up the particles and score them. We decided to use 2 regular wheels and 2 omni-wheels with a 1:2 gear ratio. After all those decisions were made we broke into groups, and I started with helping teach some people on basics of building with Brandon C. I later switched to helping with CAD and teaching Carolyn and Laurence how to use CAD, and helping Alexa with the assembly.

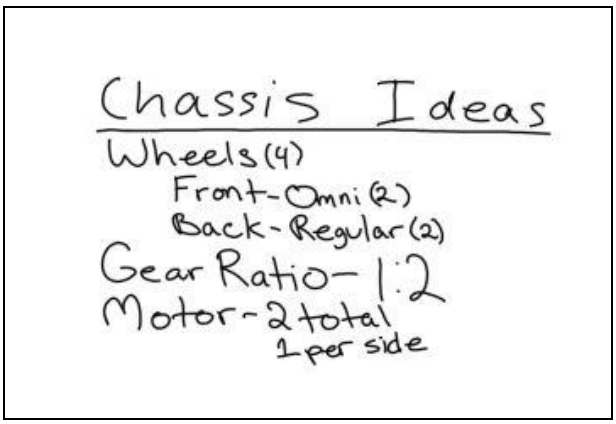
Noah D- Our team had a very good brainstorming session today. At the beginning of the meeting we discussed our plan for the design of the chassis. We decided our chassis would use wheels. There would be an omni wheel on the front on either side and a regular wheel in the back on either side. We agreed to put power to the regular wheels on the back and we plan on using a 1:2 gear ratio as we

Design:

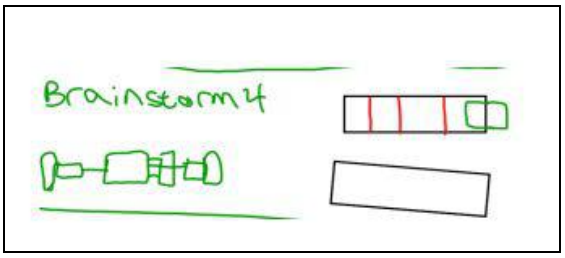
Sweeper Decision Matrix (Figure 1)

	Build Time	Complexity	Durability	Accuracy	Scoring Capability	Storage	Total
Brainstorm 1	3	3.5	3	4	4	4	21.5
Brainstorm 2	2	3	3	4.5	1	2	15.5
Brainstorm 3	2	2.5	2	4	3	3	16.5
Brainstorm 4	4	4	4	4.5	5	5	26.5
Brainstorm 5	4	3	3	3	2	1	16

Chassis Ideas (Figure 2)



Brainstorm Refining (Figure 3)



FIRST Designer: Witness:

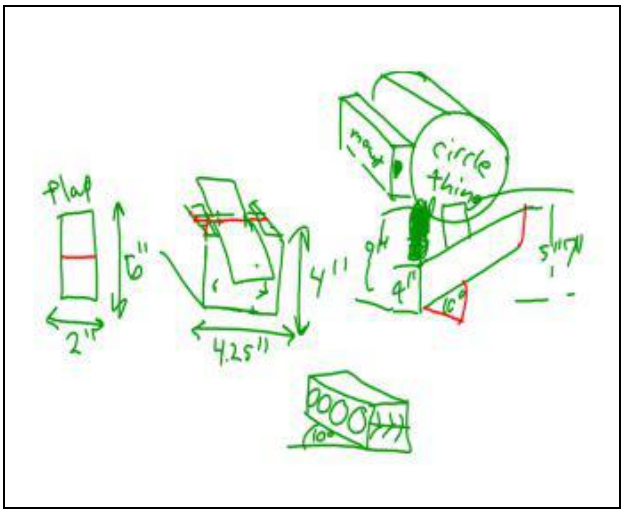
decided it would be best for our robot to be more speed oriented with this year's challenge. After we concluded the design of the chassis we brainstormed how we wanted to collect and score the particles effectively. There were a total of 6 designs that people came up with. The idea we decided to develop features a container just wide enough and just tall enough for the particles to fit through. It will go 16 inches back, so it will be able to hold four particles comfortably. It will collect the balls via two three inch sweepers attached to an axle, and when in position the sweeper will simply spin the other direction in order to score the balls in the corner vortex.

Kailey F- I was there and helped lead the team in brainstorming. We had 6 main brainstorms and then made a decision matrix to determine which one is best. We had good team discussions and everyone was engaged. However, I got sick and had to go home early so I didn't get to stay for the building.

Carolyn W- At the beginning of the meeting, we brainstormed on how we want our robot to be able to pick up the particles and then split up into groups to start building it. After we split into groups to start working, I started working on CAD with the flaps. In CAD, I got two flaps done and the part that will hold the flaps and axle. The part that will hold the flaps and particles was started but not finished yet.

Laurence (Support)- We brainstormed ideas for how the robot will score particles. We had five main ideas and decided on a tube with spinning flaps to launch the particles. Then Alexa gave me a crash course in CAD by making the chassis, which took up the last bit of time because I had never used to program before.

Sweeper Bin Brainstorms (Figure 4)



Build: X
Program: X
Test: X
Outreach: X
Mentor Interaction: X
Public Relations: X

Combustible Lemons
Team # 5466

Steps of Engineering: Prototyping

The Combustible Lemons	October 18, 2016
Goal 5: Our team wants to have good team dynamics and have a strong bond. We want to become more like a family.	**Start Time:** 3:15 PM **End Time:** 8:00 PM

Daily Summary

Design	Build	Program	Test	Outreach	Public Relations
-End Effector Redesigned -Worm Gear	-Gripper Arms -Structure Stability Improvements	-Convert Autonomous to LinearOpMode	-Gripper Arms -Pitching Machine	-Teach Another Team to Code	X

Reflections

Design:

Mason H- During my intermission period while waiting for the phones to test the robot, I redesigned the end effector collector in CAD. By using the baseplate as a guider, I redesigned the other pieces to fit that piece.

Jenna S- When the meeting was over I started working on CAD with Carolyn and Mason wanted me to work on the end effector while he did some building with Noah. I didn't get to finish the end effector so I'll do that next time.

Carolyn W- I continued in CAD with putting on the technology and partly helped on redesigning the end effector. I was going to try driving a robot, but there were issues with the phones. Then I had to leave early for a concert, but I came back in time for the team meeting at the end.

Cody N-B- I attempted to help with CAD and try to learn something from doing it, but ended up getting very confused. A few of the piece didn't fit together and we had to recreate them correctly, which ended up being quite difficult. Putting little circles onto a piece of purple plastic turns out to be difficult.

Build:

Mason H- I attached the new bent plates to the gripper arms, in the hopes that the plates would allow larger surface area to grab the cap ball. I placed two longer plates in the center of the arms. Upon testing, this did not work effectively, and I proceeded to change

Initials

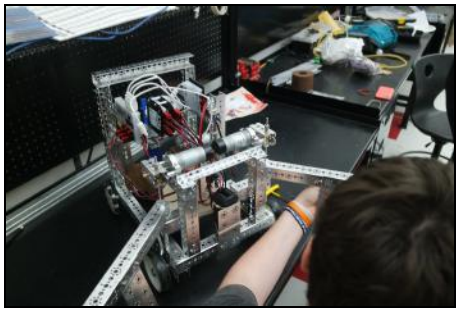
Assorted Graphics

Design:

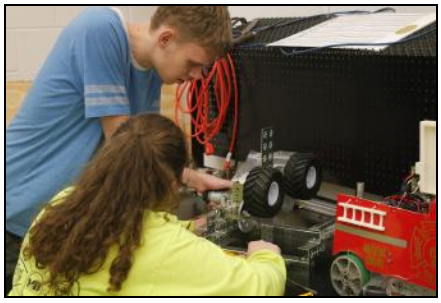
Designers Working In CAD (Figure 30)

Build:

Refining of Gripper Arms (Figure 31)



Refining of Pitching Machine (Figure 32)



FIRST Designer:

Witness:

the shorter plates near the front, to become the new plates that had larger surface area. Testing this idea, it worked rather effectively and Noah and I were able to successfully lift the cap ball. George and I also rebuilt the end effector from acrylic and decided to redesign it in CAD to be more effective in practicality.

Kailey F- I continued working on the pitching machine with Brandon. The new wheels allow us to have enough power with only a 1:9 gear ratio. One of the tires, however, does not have enough support on the channel so it wiggles back and forth. We added more support to it and we also added another plate to guide the ball into the machine.

Brandon S- I fixed our stand for the motor that drives the pitching machine, and attached the big gear straight to the motor now so it is no longer driven by an axle coupled to a motor.

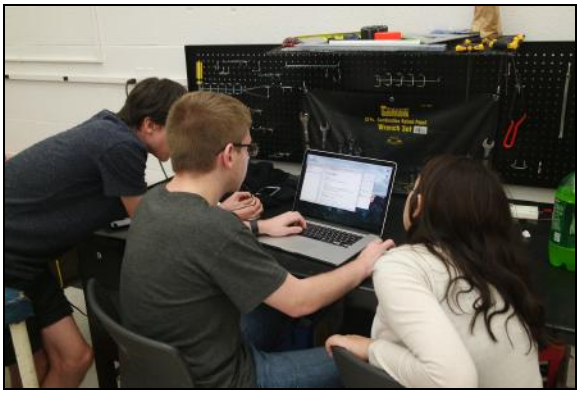
Noah D- I worked with Mason in continuing our attempts to pick up the cap ball. Unfortunately, we were still unable to accomplish it at this meeting. It is possible that we will not be able to pick up the cap ball if continue to try to grab it from the side, as we have tried multiple combinations of friction and slickness.

Brandon C- I began the meeting by helping Mason prepare some plates for the gripper arms. We bent two flat plates at a 45 degree angle. I then began working on our safety manual for the year. It contains basic safety information, such as the necessity for personal safety equipment, as well as procedures and safety measures at competitions. I took a short break from this to help Kailey and Brandon S mount the particle launcher. When Coach Mr. Franzenburg returned, Michael and I talked to him to get floor plans, so that we can make a fire escape route. We ran out of time for this, and so we are going to continue

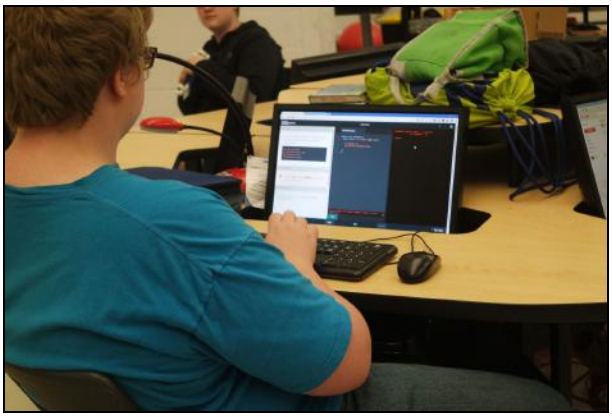
Assembly of Acrylic End Effector (Figure 33)

Program:

Programmers Working On Autonomous (Figure 34)



Programmer Working In CodeCademy (Figure 35)



on Thursday.
Michael F- I began by helping Mason with the plates for the gripper arm and the moved over to the safety manual with Brandon C. For the safety manual we copied the frc manual and fixed grammatical errors, after we had fixed the errors Mason had suggested that we add a fire safety section. We had to wait for Mr. Franzenburg so we began working on the pitcher machine for Brandon S. When we were near completion, I had to go to a Gear Up Iowa meeting in the cafeteria. When I had come back I continued working on the pitching machine until Mr. Franzenburg had got back. When Mr. Franzenburg had gotten back Brandon C, George, and I had gotten a floor plan of the rooms from him. We decided that we would finish mapping out escape routes on Thursday.
George M- I had helped Mason rebuild the end effector and we decided to redesign it. Also I had been grouped up with Brandon C. and Michael F. for a small project. We were in charge of making fire escape routes on the floor plans of certain parts of where we work.
Program:
Chance C- I worked on autonomous with Brandon R. and Alyssa to determine what we were going to do to get to one of the beacons with the robot. We had to multiply the degrees by 4 to get what the actual degrees the robot was turning. After we figured that out, we estimated that the robot should turn about 70 degrees, but that was too much. We also needed to move a little farther out from the wall. We are going to try a 60 degree turn and drive 4 inches from the wall instead of 1.

Test:
Testing Cap Ball Gripper (Figure 36)

Outreach: X
Mentor Interaction: X
Public Relations: X

Combustible Lemons
Team # 5466

Steps of Engineering: Evaluating

The Combustible Lemons	November 10, 2016
Goal 4: We want continuously seek out mentors in our community along with engaging the mentors we already have.	**Start Time:** 3:15 PM **End Time:** 8:00 PM

Daily Summary

Design	Build	Program	Test	Outreach	Public Relations
-Mecanum Chassis -Robot Armor	-Particle Cannon	-Mecanum Wheels	-Driver's Practice	-FLL Jr. Robot	-Packing -Presentations

Reflections	Initials	Assorted Graphics

Test:

Noah D- Our drive team was able to get a lot of practice in today. This was pretty much the focus of our day and the tests went very well. We worked on communication and I noticed as the night went on the driver's were getting better and better.

Mason H- I did many test drives with our robot. Brandon S and I continued our driver's practice and communication in matches. We simulated many matches, timing out autonomous and teleop and scoring as high as we could. Our score range was around 60-80, depending on the random occurrences of beacons, the capball, and other uncontrolled variables. We also ran a scrimmage match against the Mortal Combots, to imitate a real match in competition.

Kailey F- I recorded data while Mason, Brandon S, and Noah were driving. We have over 20 matches recorded and we even ran some practice matches against our sister team, The Mortal Combots. I also am going to be leading the scouting, so I grabbed the other people who are with us and had them practice while we are running matches.

Brandon S- Mason, Noah, Kailey and I practiced driving for the upcoming competition for the majority of the meeting. We ran large quantities of practice matches while recording the results, and also conducted a scrimmage match against the Mortal Combots, our sister

FIRST Designer:

Witness:

team. This practice allowed us to develop an understanding of what needs to happen before each match at competition, and be as prepared as possible to become a competitive team at our first competition.

FIRST® Designer:

Witness:

Combustible Lemons
Team # 5466

Steps of Engineering: Presenting

The Combustible Lemons	November 12, 2016
Goal 5: Our team wants to have good team dynamics and have a strong bond. We want to become more like a family.	First Competition

Positive Things

- Presentation Was Accurate
- 5th Place
- Highest Qualifying Score Without Penalties
- Had Fun
- 3rd Highest ranking point
- Robot Consistently Worked
- Sister Team Won Matches
- Assisted Other Teams
- Team Spirit Was High
- Volunteered
- Driving
- Scouting
- New Ideas For Team/Robot

Not Positive Things

- Autonomous Inconsistencies
- Beacon Problems
- Work on Presentation
- Pits Organization
- Pre-match Scouting

FIRST Designer: Witness:

Combustible Lemons
Team # 5466

Problems: Armor Damaged; Axle Bending
Solutions: Assemble New Armor; Add Supporting Structure

The Combustible Lemons	January 17, 2017
Goal 5: Our team wants to have good team dynamics and have a strong bond. We want to become more like a family.	**Start Time:** 3:15 PM **End Time:** 8:00 PM

Daily Summary

Design	Build	Program	Test	Outreach	Public Relations
-Design of Armor -Robot Alterations	-Servo Rack & Pinion -Repair Idler Axle	-Integrated Z Value -Detect White Line		-STEM Night Brainstorms	-Photography

Reflections | **Initials** | **Assorted Graphics**

Design:

Jenna S- Kailey and I took part of the conveyor system apart, but we ran out of time. The builders took over when the meeting started. I then worked on CADing the new changes to the robot to make sure it worked. We decided to make the axis shorter and put supporting channels to use space. This solution proved to work and did not make the axis bend anymore.

Cody N-B- For a majority of this meeting, I worked on creating a scouting sheet on paper rather than a spreadsheet. We've decided that syncing the documents is too difficult and well now have four scouters, and one person to input the data into the same spreadsheet that will calculate how much that specific team their alliance during a match as well as the total points scored. This will help us when choosing teams to be on our alliances and help us to sell our own robot/team to other teams during alliance selections.

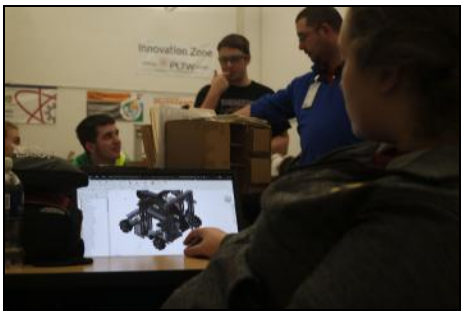
Carolyn W- Alexa and I worked together to get new armor panels made since the screws went through the old ones. We got everything measured out, cut, sanded, and made sure that it will all fit. After we got that done, we started to figure out where we are going to put the screw holes and making sure we had enough chalkboard spray paint.

Build:

Brandon S- I worked on repairing our servo

Design:

Revising Robot In CAD (Figure 128)



Revising Armor Designs (Figure 129)

Build:

Fixing Axle Bending (Figure 130)

FIRST Designer: Witness:

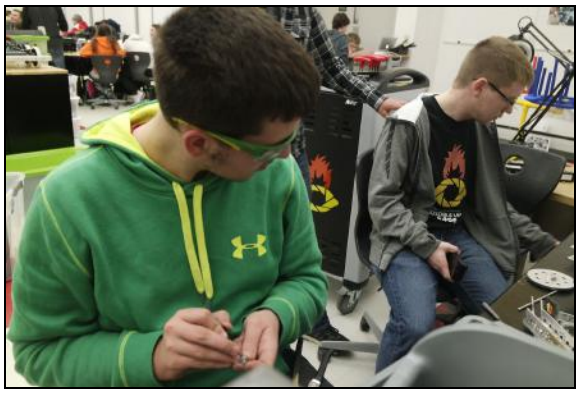
for the rack and pinion in order to push the beacon buttons during the autonomous period. The servo previously assembled had been over torqued by human interaction damaging the internal mechanical stops. This required for us to replace the servo, causing me to disassemble our servo block supporting the servo and install a new 180 degree servo.

Alexa C- Carolyn and I worked on creating a new set of armor. The bolts got over tightened on our current set and have gone straight through the panels. After taking the dimensions from the current set, we cut out the side panels and fitted them for the motors. Since the robot's structure has changed, we also had to edit the front and right top plate.

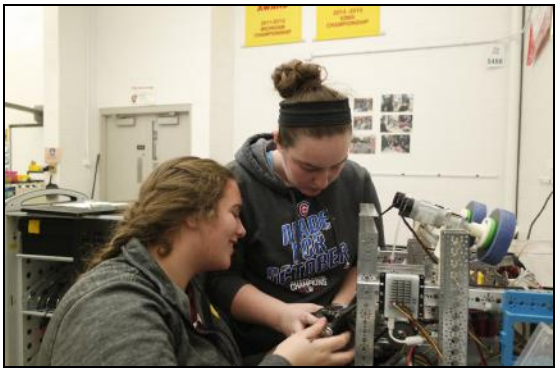
Kailey F- I worked with Jenna on fixing the issue of an axle being too long. To do this, we took off the top part of the conveyor belt system. After that, we had to figure out how to get the channels to fit. The holes didn't line up, however, so we had to move the channel our motor was on down. This created issues because there was a stripped hub which didn't allow us to get the axle moved without taking the entire conveyor belt system off. When we got to this point, Mason and Noah took over.

Mason H- I began this meet by reassembling the idler axle for our conveyor system. This required removing the previous motor for this system, relocating it to a lower position, then reassembling the lower portion of the system identical to its previous positioning. The upper portion was remodeled with more support structure by adding additional channels for a shorter axle to travel through. This shorter axle was installed on the upper idler and allows the system free rotation around that axle. The channels are oriented upside down to allow for easier access to the

Disassembling Axle System (Figure 131)



Reassembling Intake System (Figure 132)



Program:

Determining the Properties of the Gyro Sensor (Figure 133)

inner workings of the system.
Brandon C- I started off the meeting by helping Mason repair our idler axle for the conveyor. I worked for a while on replacing the axle, as several of the hubs were stuck on burrs in the axle. It took a while to get these off, but when I finished up with them, I caught up on some homework.
Michael F- I helped Brandon S With his autonomous beacon presser today by helping him cut out foam for the end and attaching that foam with duct tape. Later on I had filed down some rough axles.
Program:
Chance C- I created various autonomous scenarios for Brandon R, and I helped him create the field on a piece of paper faster. After that, I created an account on BItbucket, so Brandon could add me to the project. I added batteries to the beacons as well. I helped Brandon test the gyro sensor and logged which direction displayed what numbers (positive infinity and negative infinity). We also tested for the highest value that the white line displayed most frequently and logged it before cleaning up.
Brandon R- The goals of the programming team today we were solidifying an autonomous to press one beacon button and design other autonomous scenarios to complement other robots at our League competition. We also did something that was long overdue - document the behavior of our gyro sensor. Since the beginning of experimenting it, we put our integratedZValue in absolute value so we didn't have to deal with sign flips and which direction was positive or negative. It worked for our needs at the time, but we now realize how much more flexibility we have by understanding how it works.

Test: X
Outreach: X
Mentor Interaction: X
Public Relations: X

Combustible Lemons
Team # 5466

Robot Specifics: CAD; Sketches; Dimensions

The Combustible Lemons	January 5, 2017
Goal 2: We want to have a robot that is competitive in both scoring capability and design.	**Start Time: 3:15 PM** **End Time: 8:00 PM**

Daily Summary

Design	Build	Program	Test	Outreach	Public Relations
-Armor -Exploded Robot View	X	X	-Autonomous -Drive Practice	-STEAM Event Planning -Outreach Pages	-Write biographies

Reflections | **Initials** | **Assorted Graphics**

Design:

Alexa C- I finished the armor! All of the pieces have been painted and are ready to be mounted. The multi-plate design is a success and will hopefully stay that way for competition. I did some research on the chalk markers and we need mineral spirits t completely clean it off of the armor.

Carolyn W- Kenna and I worked together to do an exploded view of the robot. We then worked together on researching one of the awards that we want to qualify for. After we started that, I brought up my CAD files so Brandon S. can work on infographics for th presentation board.

Jenna S- We took pictures in the beginning of the meeting. After we were done I fixed Alexa's CAD because the orientation was n correct. I tried it a one way the first time bu things became messed up, so I hit undo. I used the orbit and made one side of the robot the front and fixed the side angle. I se everything then they started working on infographics with photoshop.

Mackenna B- We took team pictures in our team shirts and hats at the beginning of the meeting. Then Jenna, Carolyn, and I worke on organizing the robot and fixing Alexa's CAD. I then helped test run the robot and time it.

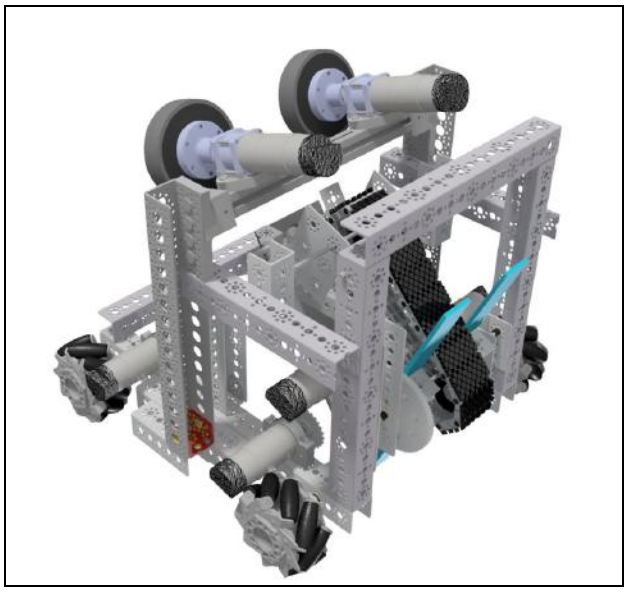
Build:

Program:

Test:

Design:

Robot In CAD (Figure 125)



Build: X

Program: X

Test:

Sample Autonomous Tests (Figure 126)

Implementation of Design Iteration #2 (Stitch)

		Autonomous				Tele-op			
Match Number	Alliance Color	Particles in center	Beacon Press	Capball Knock	Partial Park	Particles in Center	#Beacons	Final Score	Penalties
37	Blue	2	0	0	0	5	4	95	0
38	Blue	2	0	0	0	4	4	90	0
39	Blue	1	0	0	0	3	4	70	0
40	Red	2	0	0	0	2	4	80	0

FIRST Designer: Witness:

The Combustible Lemons

Goal 2: We want to have a robot that is competitive in both scoring capability and design.

January 5, 2017

Start Time: 3:15 PM
End Time: 8:00 PM

Brandon R- Autonomous tests today were as successful as we've ever had in our new Casper program, as viewed in Figure 127. Our tests proved that the robot is more successful than in previous trials of not only getting our particles in, but also knocking tl capball off the center at the end.
Noah D- Today we wanted to focus on testing autonomous and allowing Mason ar Brandon S to get some more drive practice. And we were able to get a pretty decent amount of autonomous tests which showec that our autonomous was pretty successful But when we began testing for tele-op drive practice, we received an error that froze ou robot. The error said "stuck in loop()" at firs we were expecting this to be a fairly simple issue to solve. But we kept getting this issu and when we got it our robot would becom unable to move, which is clearly something that we had to make sure was fixed. Brandon R. and I spent the meeting with some help from Mr. Brosius and David Vick on trying to solve it. We narrowed the problem the down far enough to understan the issue was being caused by the phones dropping their wifi connection.
Brandon S- Mason, and I drove matches in order to train our shooting using the pitchin machine by simulating the matches for the upcoming competition. We tend to only adjust our motor speed to account for the battery voltage in order to have a standard for where we can shoot from on the field.
Mason H- Brandon S and I were able to practice driving some more with full match mimicry. We ran numerous matches, scorin between 2 to 6 particles in the center vorte each time. We also were able to score all four beacons in the last 30 seconds, consecutively.

Autonomous Percentages (Figure 127)

Average Score (1st iteration)	
63	
	Point differential between iterations
	20
Average Score (2nd Iteration)	
83	
Average Autonomous (1st iteration)	
17	
	Autonomous Differential between iterations
	9
Average Autonomous(2nd Iteration)	
26.25	
Cap Ball Success Rate	
68%	

Outreach: X
Mentor Interaction: X
Public Relations: X

FIRST Designer:

Witness:

The Combustible Lemons	December 8, 2016
Goal 1: We want to take our knowledge gained from FIRST to Kenya in order to teach Kenyan youth the problem-solving skills they need to impact their daily lives.	**Start Time:** 3:15 PM **End Time:** 8:00 PM

Daily Summary

Design	Build	Program	Test	Outreach	Public Relations
-80/20 Mount -CAD Robot	-Chain and Sprocket for Mecanum -80/20 Mount	-Nemo Autonomous	X	-Care Package	-Judges Video

Reflections

Mentor Interaction:

Brandon C- Along with Mason, Brandon S, and Kailey, I worked with Mr. Fellner on the math for the pitching machine. We learned basic projectile physics, as well as basic trig that would help us maximize the effectiveness of our pitching machine.

Brandon S- Kailey, Brandon C, Mason and I worked with our mentor Chris Fellner in order to learn the math of our pitching machine using vectors. This taught us basic Trigonometry, and Project Motion Physics. We also learned the process of determining our design parameters and constraints to learn what we plug into our equations, and what we use our equations to find.

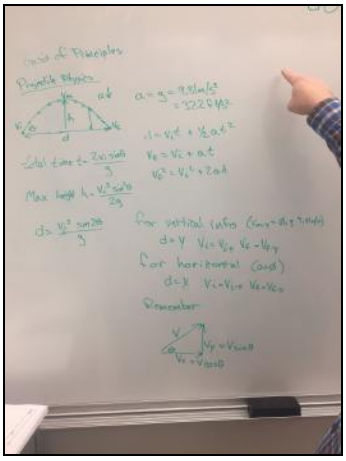
Kailey F- Our new mentor, Chris Fellner, came in. He taught people working on the pitching machine robot some math to use. He taught us vectors, a little bit of trig, and some projectile motion equations. We also learned about design parameters and design constraints, and we applied it to our pitching machine. We also learned about Design of Experiments and how to apply it to what we are doing.

Initials

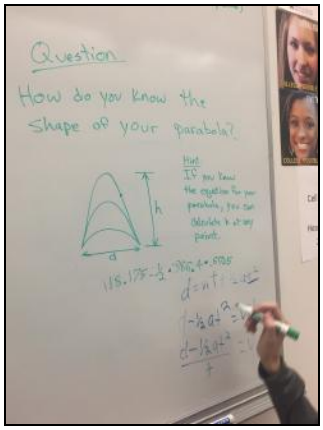
Assorted Graphics

Mentor Interaction:

Being Taught Algorithms for Velocity and Trajectory (Figure 90)



Being Taught Algorithms for Velocity and Trajectory (Figure 91)



FIRST Designer:

Witness:

The Combustible Lemons	December 8, 2016
Goal 1: We want to take our knowledge gained from FIRST to Kenya in order to teach Kenyan youth the problem-solving skills they need to impact their daily lives.	**Start Time:** 3:15 PM **End Time:** 8:00 PM

Being Taught Algorithms for Velocity and Trajectory (Figure 92)

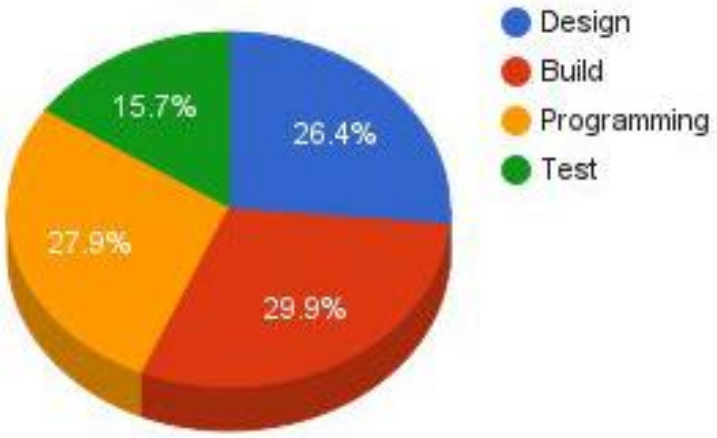
Public Relations: X

FIRST Designer:

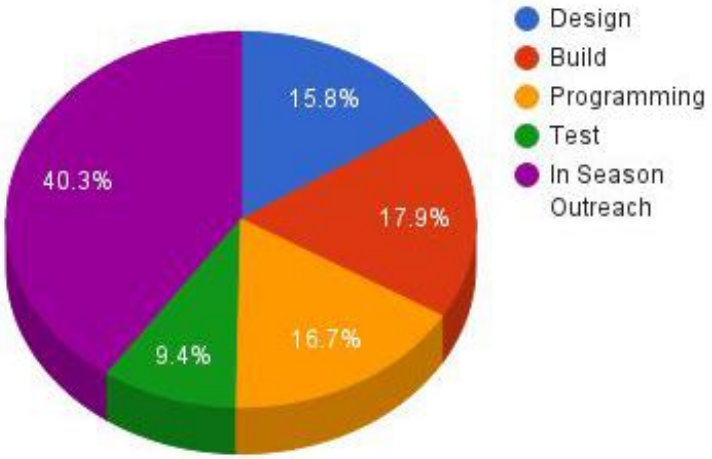
Witness:

Pie Charts

Robot Hours Distribution



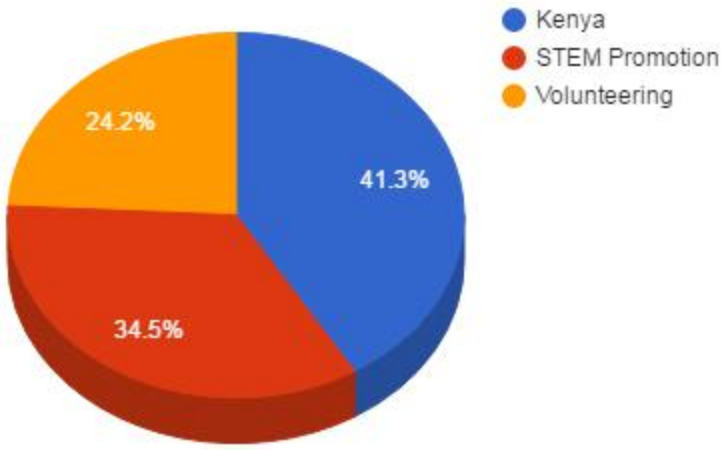
In-Season Hours Distribution



FIRST® Designer: Witness:

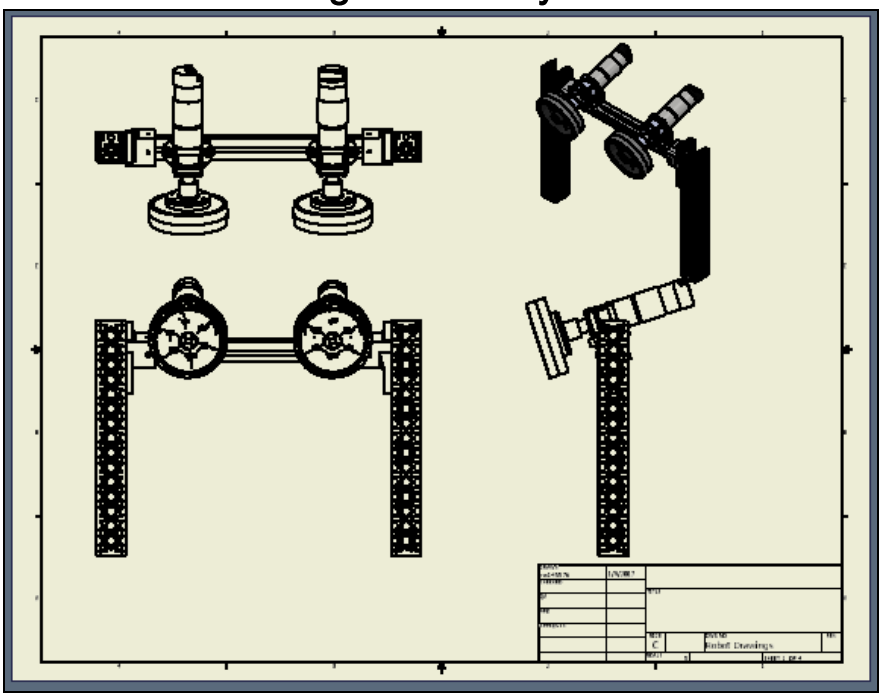
Pie Charts

Outreach Hours Distribution

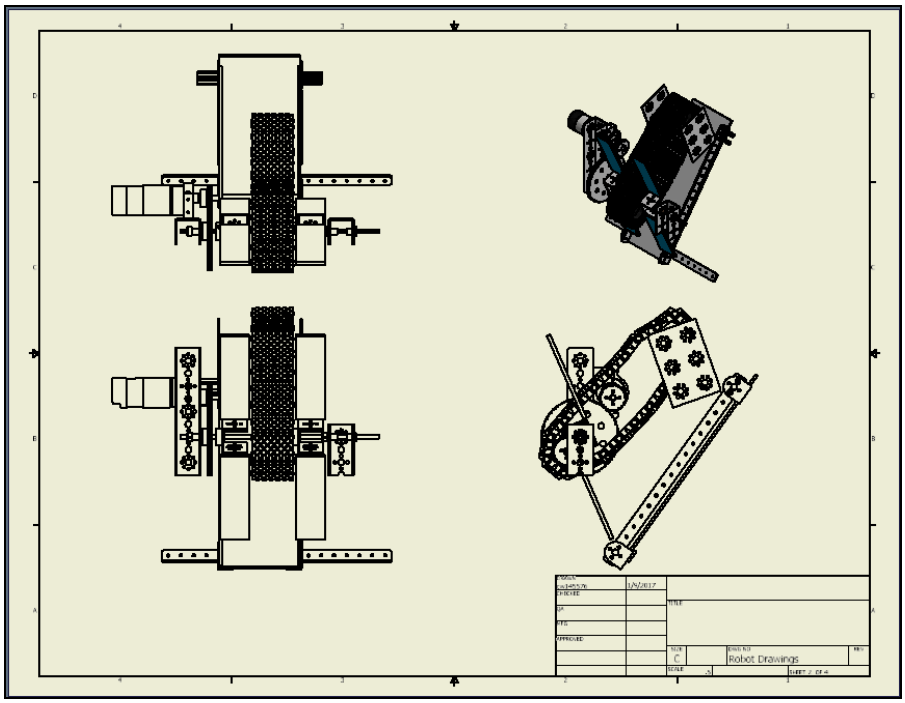


Technical Drawings

Pitching Machine System

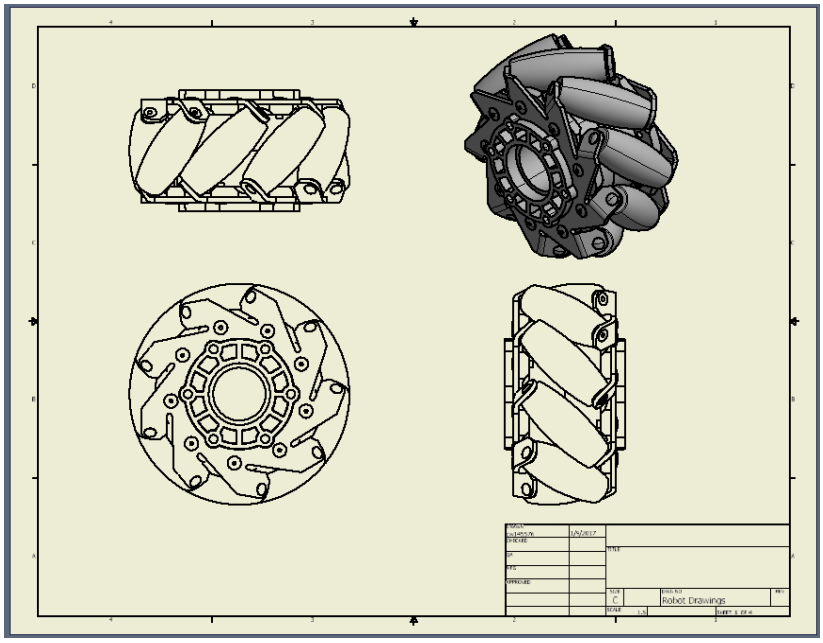


Intake System

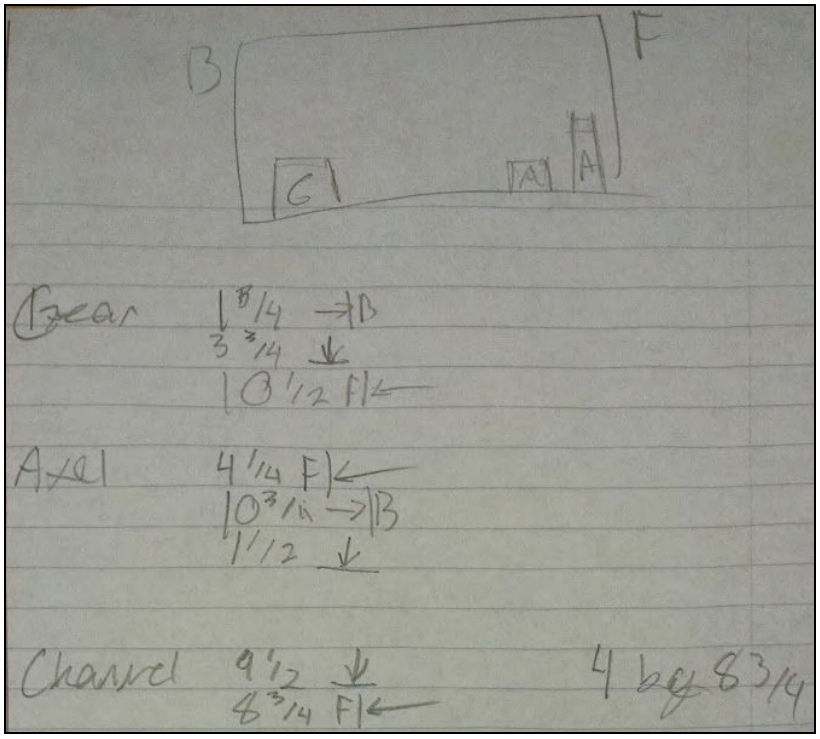


Technical Drawings

Mecanum Wheels



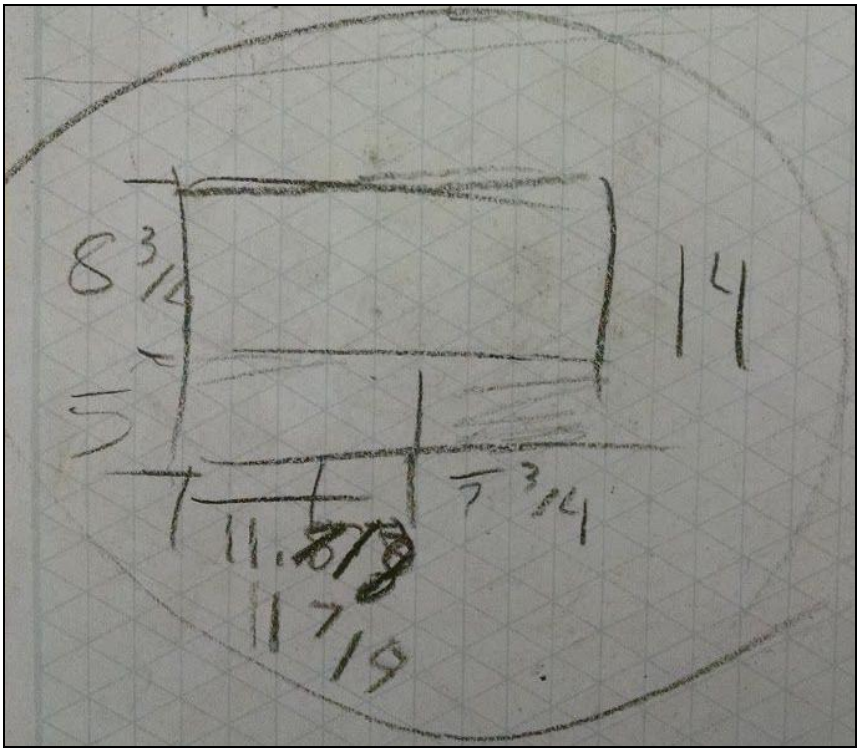
Armor - Side Panel



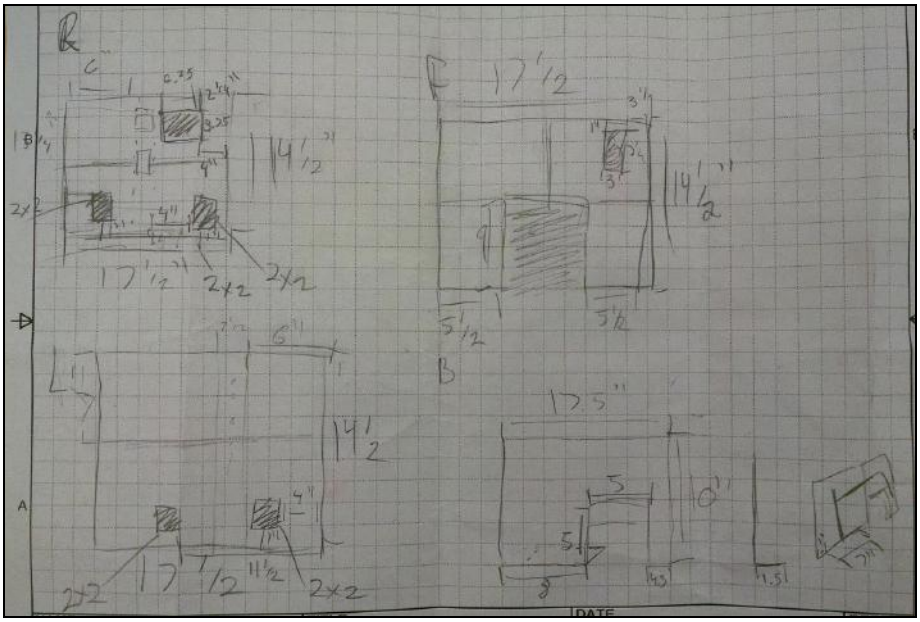
FIRST® Designer: Witness:

Technical Drawings

Armor - Multi-Plate



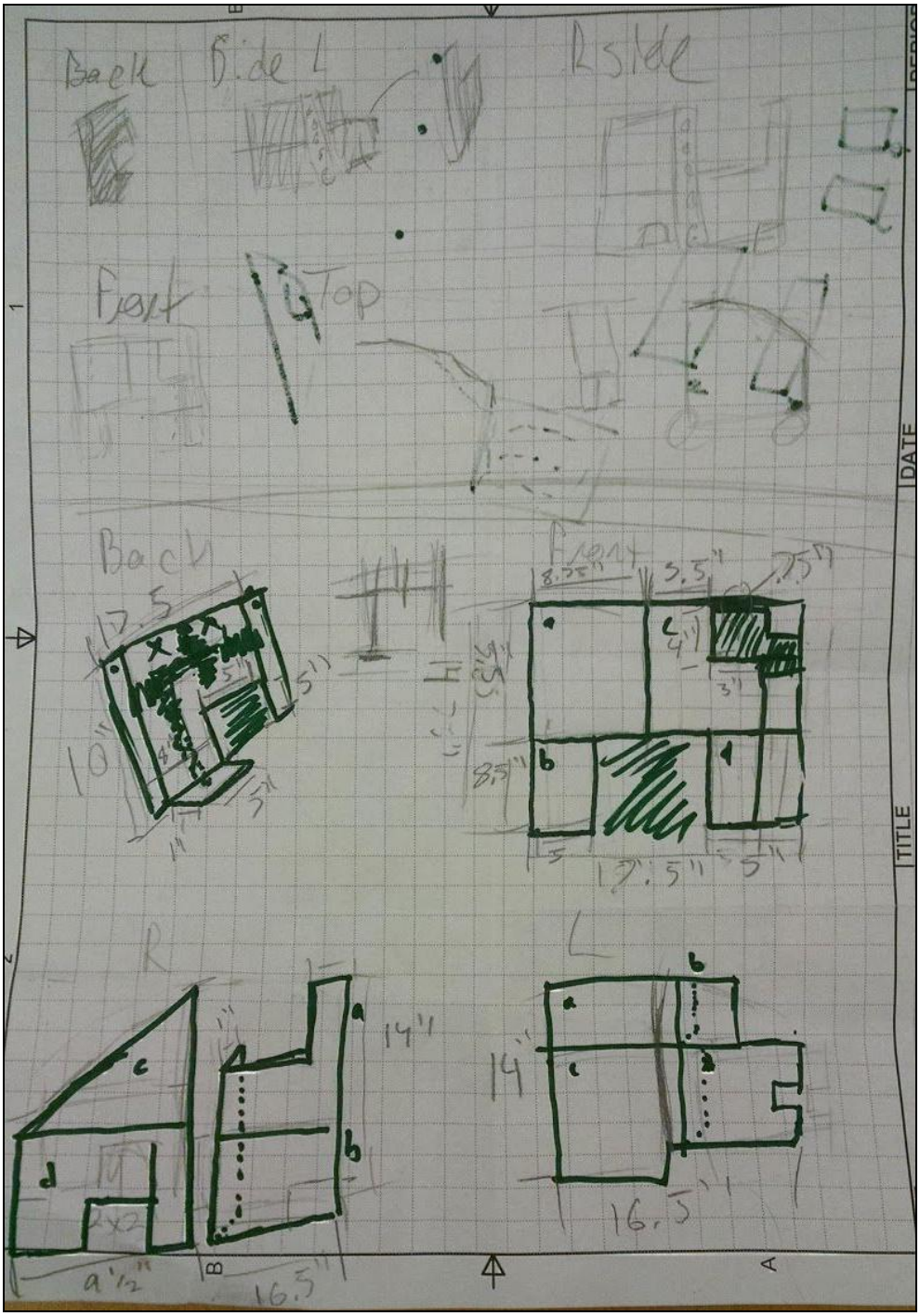
Armor - First Multi-Plate Set



FIRST® Designer: Witness:

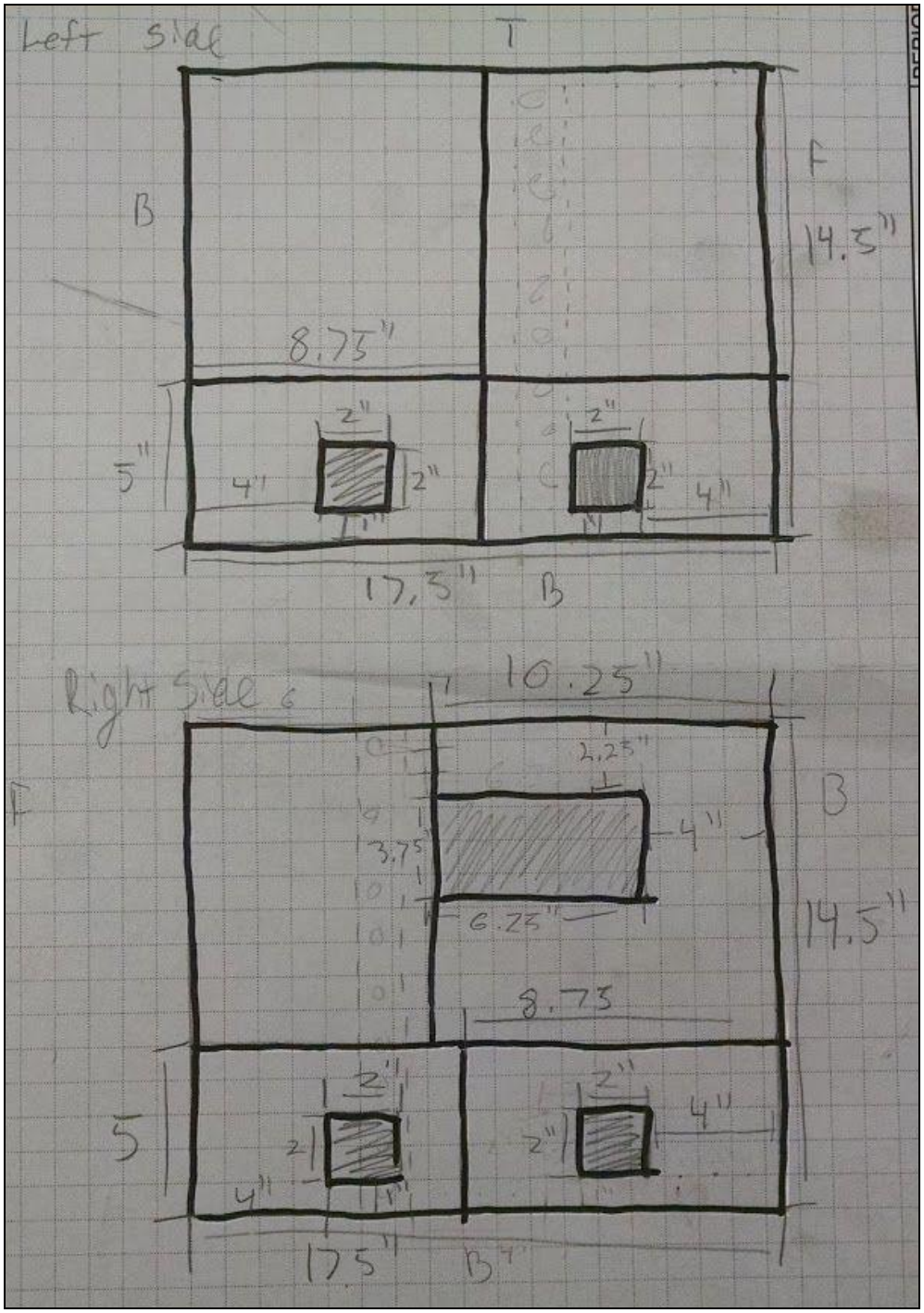
Technical Drawings

Armor - Multi-Plate Set



Technical Drawings

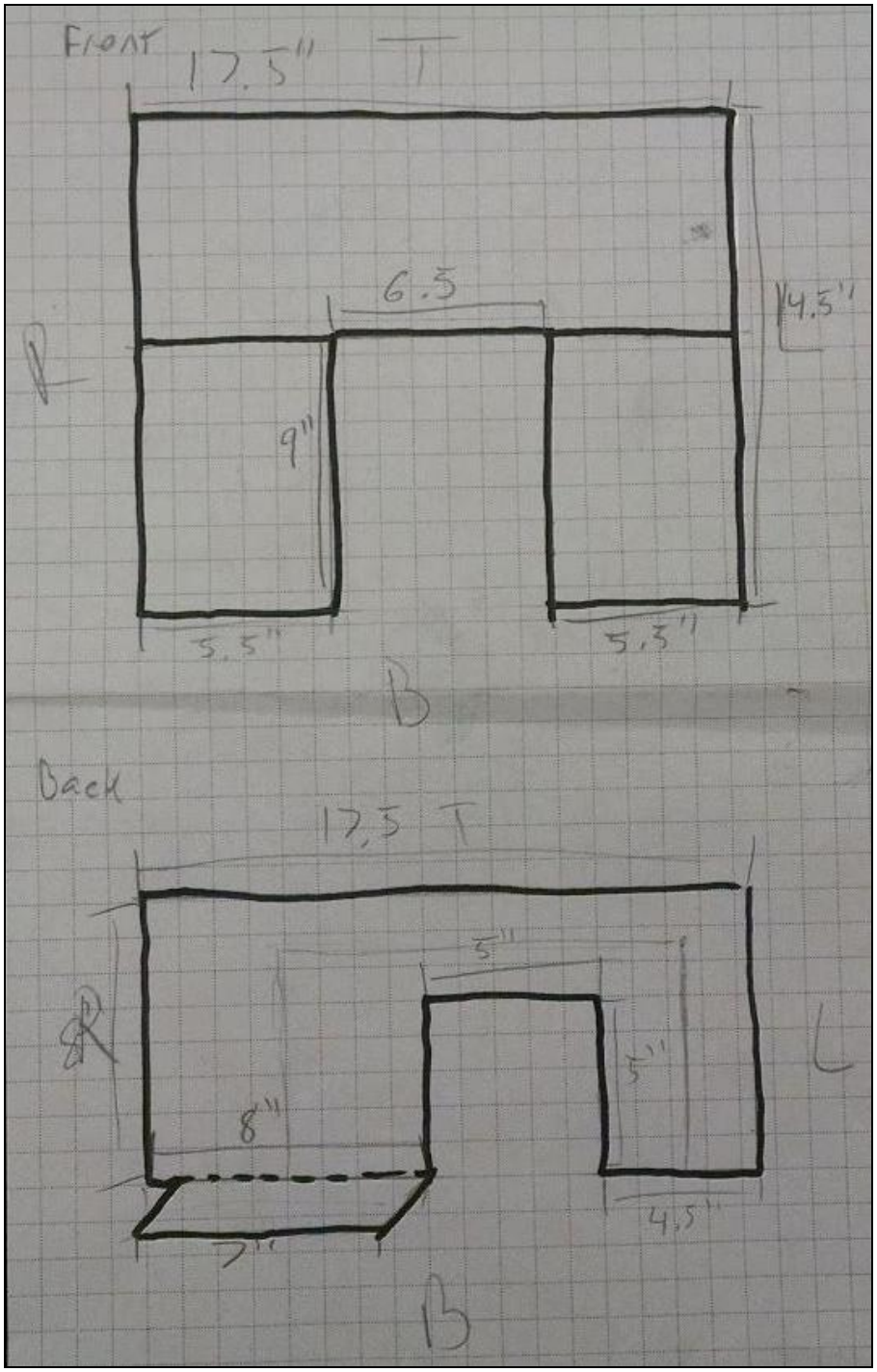
Armor - Side Plates



FIRST Designer: Witness:

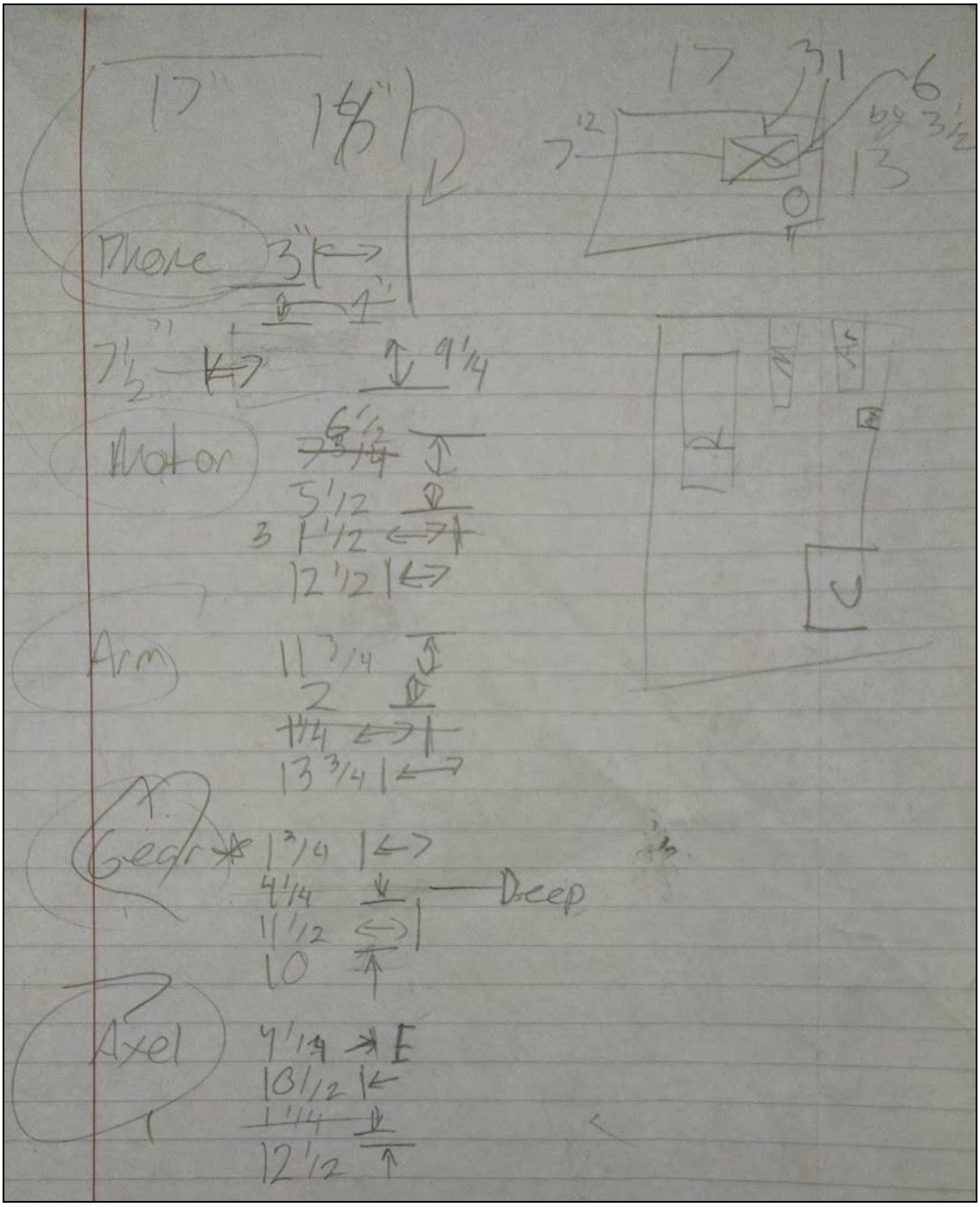
Technical Drawings

Armor - Front & Back Plates



Technical Drawings

Armor - Side Measurements



FIRST Designer:

Witness:

Combustible Lemons
Team # 5466

Organizational Tricks

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October 18th, 2016	Blue (1) - Building
November 10th, 2016	Red (2) - Programming
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09/06/2016 Homecoming Parade	**16**	**205**
09/10/2016 FTC Kickoff	**17**	**15**
09/25/2016 Fire Station Volunteering	**18**	**200**
10/01/2016 FLL Mentoring	**19**	**380**
11/05/2016 STEAM Fest	**20**	**28**
11/15/2016 8th Grade Orientation	**21**	**32**
11/17/2016 Care Package Project	**22**	**419**
11/19/2016 Smiles for Soldiers	**23**	**26**
11/22/2016 FLL Visit	**24**	**18**
12/13/2016 Kids Against Hunger	**25**	**21**
12/16/2016 Women In Engineering Day	**26**	**38**
12/20/2016 Chromebook Packaging	**27**	**100**
01/07/2017 Mentoring an FRC Team	**28**	**230**
02/22/2017 Introduce A Girl to Engineering	**29**	**14**
02/23/2017 QCESC Banquet Demo	**30**	**12**
02/28/2017 2nd Hayes STEM Presentation	**31**	**42**
03/01/2017 Monroe STEM Presentation	**32**	**16**
03/09/2017 Jefferson STEM Presentation	**33**	**54**

03/10/2017 2nd Trivia Night Fundraiser	**34**	**92.5**
03/15/2017 Blue Grass STEM Presentation	**35**	**35**

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➢ Fran Riley Interview 05/03/2016	**5**	**7**
➢ Solar Energy Lessons 06/14-27/2016	**6-7**	**784**
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➢ Care Package Project 11/17/2016	**22**	**419**
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➢ Kids Against Hunger 12/13/2016	**25**	**21**
➢ Chromebook Packaging 12/20/2016	**27**	**100**
➢ 2nd Trivia Night Fundraiser 03/10/2017	**34**	**92.5**

STEM Promotion		
➢ Hayes Presentation 05/01/2016	**4**	**24**
➢ Mississippi Valley Fair Demo 08/05/2016	**12**	**89**
➢ Blue Grass Drive-In Demo 08/21/2016	**13**	**60**
➢ Starting an FRC Team 08/24/2016	**14**	**52**
➢ FLL Kickoff Demo 08/24/2016	**15**	**10**
➢ Homecoming Parade 09/06/2016	**16**	**205**
➢ FTC Kickoff 09/10/2016	**17**	**15**
➢ FLL Mentoring 10/01/2016	**19**	**380**
➢ STEAM Fest 11/05/2016	**20**	**28**
➢ 8th Grade Orientation 11/15/2016	**21**	**32**
➢ FLL Visit 11/22/2016	**24**	**18**
➢ Women in Engineering Day 12/16/2016	**23**	**38**
➢ Mentoring an FRC Team 01/07/2017	**28**	**230**
➢ Introduce A Girl to Engineering 02/22/2017	**29**	**14**
➢ QCESC Banquet Demo 02/23/2017	**30**	**12**
➢ 2nd Hayes STEM Presentation 02/28/2017	**31**	**42**
➢ Monroe STEM Presentation 03/01/2017	**32**	**16**
➢ Jefferson STEM Presentation 03/09/2017	**33**	**54**
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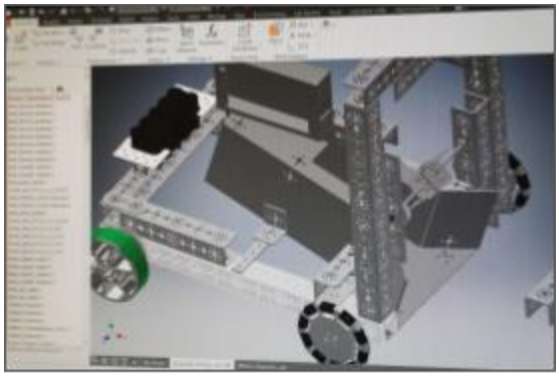
Appendix

Specialty Pages

The Combustible Lemons - Engineering Summary

Design:

To begin designing our robot, our team uses a system of events to determine the best outcome for our desired robot. In the beginning, all members input a brainstorm or idea, which were then voted on to lower the numbers to approximately 5 or 6 brainstorms. These were then input into a decision matrix and decided upon in this matrix. The first instance of this occurred when our team decided to score in the corner vortex at the first competition using a singular sweeper, with a rectangular storage unit for maintaining 3 particles at a single time **(Figure Right)**. Another instance of this would be when we decided whether to use a torque-based or speed-based robot. Our members created a matrix and decided based on the highest scoring option. Our team also uses Autodesk Inventor to discover any problems or occurrences within our planned robot. Inventor also allows us the ability to 3D-Design any custom parts which may be needed. Many versions of these parts can be seen on our current robot. An example would be that of the custom bracket **(Figure Left)**, which attaches our servocity channels to tetrix channels without any hassle. The custom design allows the two channels to be managed without having to drill or alter our materials specifically for this build. Other instances include our adapters for banebot motors to 80/20 channels, custom banebot to wheel mounts, custom angle brackets for our pitching machine, and a custom modifiable phone case. CAD allows our team much more flexibility in the designing phase of FTC and allows us to understand our problems before they surface in reality.



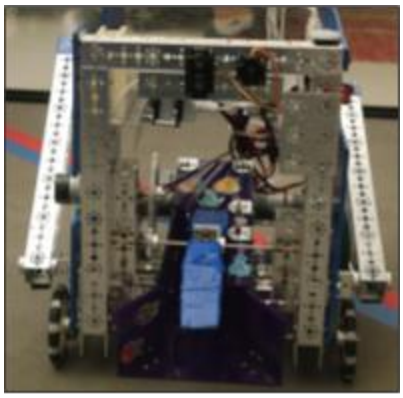
(First Robot Design in CAD)

(Custom Bracket)

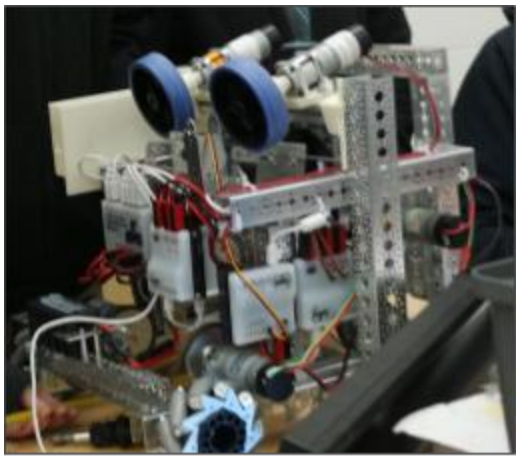
(Second Robot Design in CAD)

Build:

Building the physical robot requires many hours and time devoted to correcting anything that goes wrong. We began the season by building one robot, which we dubbed “Nemo”, for the first three competitions. This robot shot particles into the corner vortex, lifted the cap ball to low height, scored beacons, and removed the cap ball in autonomous **(Figure Right)**.



(First Robot Built)

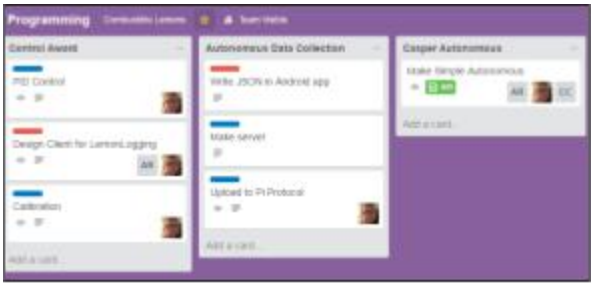


(Final Pitching Machine)

Our team also uses 3D-Designed systems to physically build the systems and later test them. One example would be our pitching machine, which ran through 3 iterations before eventually being finalized in a very refined and successful system **(Figure Left)**. Our team uses modular building, allowing us the ability to remove and add additional parts at ease. We also use a leapfrog method of building our robots. For the first three competitions, we used a simple robot which obtained our goals for those competitions. However, while this robot was being maintained, another robot, (Refer to Figure), was being designed and built to achieve higher goals for later competitions. This allows our team more diversity and the guarantee that we will be able to accomplish one of our 5 team goals, being competitive in the robot portion of FTC.

Program:

Over the course of this robotics season, our programming team has been able to accomplish and learn so much. The first skill that has been acquired actually spans across the entire season with visible proof - version control. From the beginning, our team has used Bitbucket as a version control solution. Branches, merges, commits, rebases, and many more key elements to version control were used to simulate what project flow might have looked like in a professional project. Another learning experience was using Android Studio rather than MIT App Inventor, which exposed us to more complicated and intricate, but ultimately more helpful ways to control our robot and sensors. Using Java to write commands and methods for our robot to utilize gave us a greater range of features than MIT App Inventor would have provided. This is just the surface, however, as our Trello for programming shows our plans, some of which we've already dove into **(Figure Right)**. The items we have been researching and beginning to program include PID control for our robot, networking and servers, and calibrating before running our autonomous so we know which motors work better than others and accommodate power for them. Our programming team has worked through multiple iterations of our autonomous to maximize the scoring potential of our different robots. Our current autonomous consists of using a Gyro Sensor to turn at a perfect angle to line up with our desired angle measured in our autonomous code.



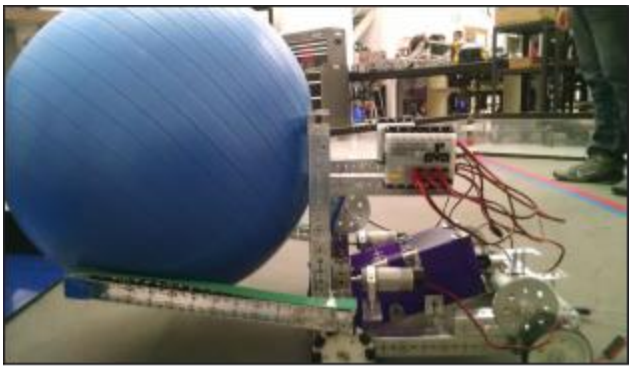
(Programming Trello)

Test:

Our team continuously tests every portion of our robot after every iteration. We often document our occurrences in spreadsheets, depicting percentages of success, failure, offsets, and other variables based on the test provided. We also ensure our tests are accurate, by being sure we begin in the same location and each test includes the same variables, based on what we are testing. Some examples of our testing would be through our continuous autonomous tests. After the third competition, our team began testing our second robot's autonomous which shoots two particles, knocks the cap ball, and parks on the center **(Figure Right)**. We also continuously test our build's practicality. Often we run into issues we could not account for in designing phase and have had to alter our build to account for these problems. We ran continuous tests to see what would be most effective against these problems, and worked our way to success through continuous testing. An example of an unexpected error was with our original cap ball lift, as the traction of the cap ball prevented it from being lifted by our robot and instead made the ball cling to the side of the robot. With adjustments, we were able to overcome this challenge and successfully lift the cap ball **(Figure Above-Left)**. Our team continuously tests each progression we make in every portion of FTC. We always document our data collected in various ways, but most often spreadsheets work out the best. Testing allows us to continue to progress and be a competitive team.

Implementation of Design Iteration #2 (Stitch)									
		Autonomous				Tele-op			
Match Number	Alliance Color	Particles in center	Beacon Press	Capball Knock	Partial Park	Particles in Center	#Beacons	Final Score	Penalties
37	Blue	2	0	0	0	5	4	85	0
38	Blue	2	0	0	0	4	4	80	0
39	Blue	1	0	0	0	3	4	70	0
40	Red	2	0	0	0	2	4	80	0

(Autonomous+TeleOP Testing Spreadsheet)



(Robot Testing Lift Mechanism)

The Combustible Lemons - Engineering Summary

This has been a summary over the engineering section of our notebook. For specific details, please read the daily entries created by our members for each of their achievements, failures, and progress. Specific dates of interest are noted below, and in the general summary page.

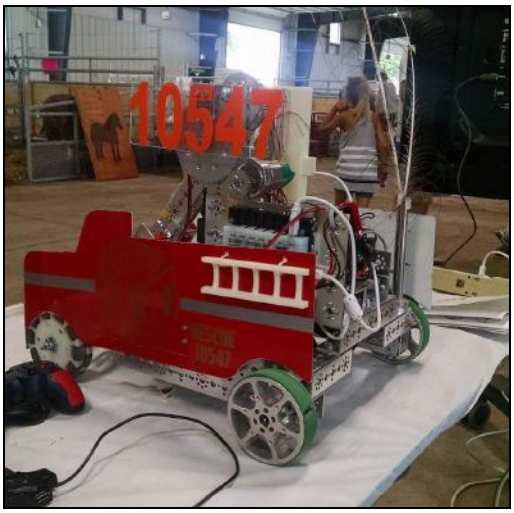
Date:	Page Number(s)	Reason for Interest
September 27, 2016	**3-4**	**Design**
October 18, 2016	**36-38**	**Build**
November 10th, 2016	**79-80**	**Program**
December 8th, 2016	**123-125**	**Mathematical Modeling**
January 5th, 2017	**167-169**	**Test**

The Combustible Lemons Hours Dedicated: 89	August 5th, 2016 Mississippi Valley Fair Demo

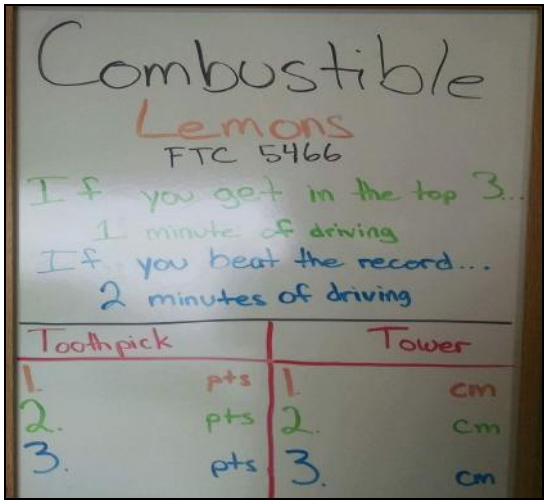
We went to the Mississippi Valley Fair this year allowing kids to work on STEM related activities and drive an FTC robot around to get them involved and enthused about the FIRST programs. One activity involved a board with circles of various sizes and corresponding point values that the participants would create a pipeline of straws above the board with toothpicks standing on top of the circles to score points. Another activity was for the participants to create a tower as high as they could create, using 15 spaghetti noodles and 10 marshmallows. We also added challenges throughout their time building the tower representing different challenges that could be faced in real life, such as budget cuts or lack of communication.

(Figure 35)

(Figure 36)



(Figure 37)



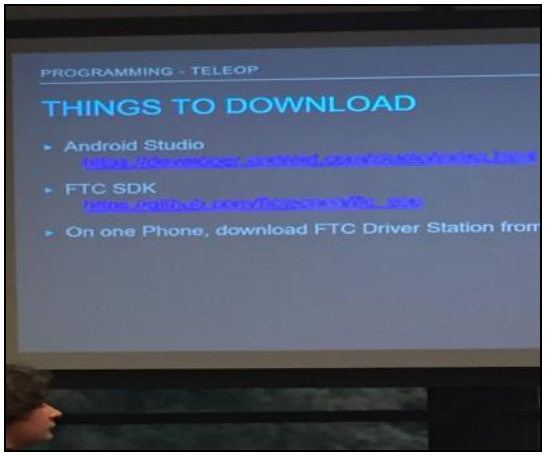
(Figure 38)

Designer: Witness:

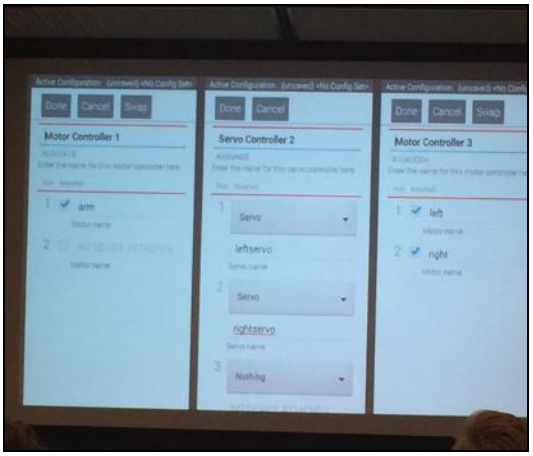
The Combustible Lemons Hours Dedicated: 15	September 10th, 2016 FTC Kickoff

At this year's FTC Kickoff, our team decided to do more than just attend. The returning Lemons from last year gave a presentation on their Kenya trip. They discussed the fundraising and planning leading up to the trip, as well as the events of the trip itself. We also had our main programmer, Brandon Richards, run a programming workshop. During this workshop, he gave lessons on the basics of programming. Several of our members also had a rookie team insights workstation. We talked to various teams that approached us, and gave them some advice on how to get up and running. We discussed the importance of good team dynamics, how to reach out to the community more effectively, and gave a quick overview of the design process.

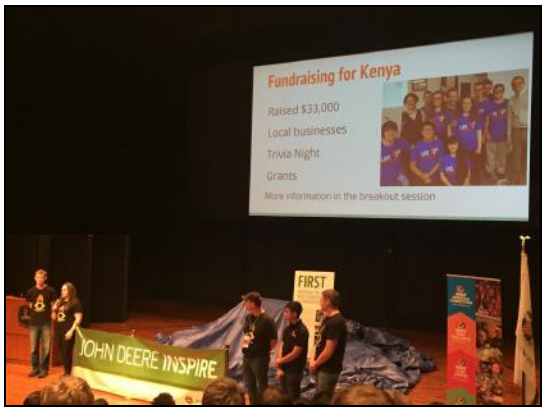
(Figure 45)



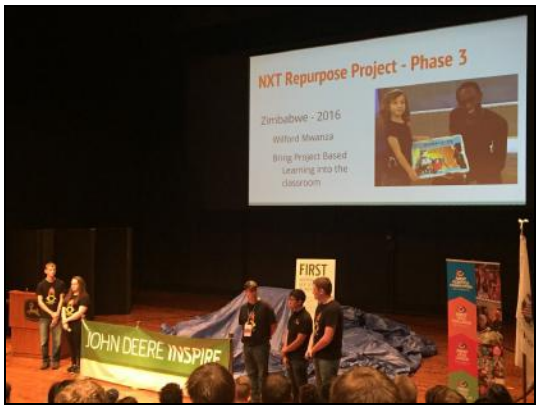
(Figure 46)



(Figure 47)



(Figure 48)



Designer: Witness:

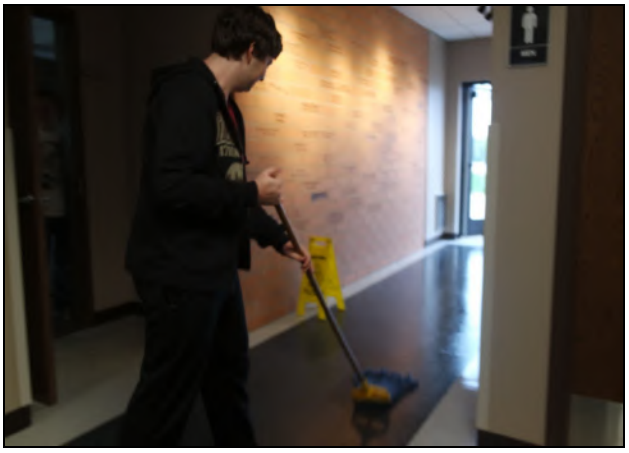
The Combustible Lemons	September 25th, 2016
Hours Dedicated: 155	Fire Station Volunteering

When most people hear the word “Hero,” they think of superheroes, such as Superman. Our team is dedicated to helping some of the real world heroes, such as the Blue Grass Firefighters. Every Sunday, we have team members go to the Blue Grass Fire Station from 8-10 to volunteer their time to the fire fighters. We consistently clean up around the fire station, doing things like picking up litter, mopping the floors, dusting shelves, and cleaning off the fire trucks, ambulances, and police cruisers. This allows the whole department to focus more on their jobs instead of cleaning up the station. We also help with various tasks as they appear, such as making copies of reports, sending letters to sponsors, organizing supplies, and filling bags full of fire prevention pamphlets to give to kids at the Blue Grass Elementary School.

(Figure 49)

(Figure 50)

(Figure 51)



(Figure 52)

Designer: Witness:

Questions:

1. How do you keep up with your notebook?
    a. Our team ensures at each meeting all members have completed previous entries, and are reminded if they have not. Often, our team would conclude a meeting with everyone documenting their daily occurrences.
2. What is the process for documentation?
    a. Our notebook is recorded in separate sections, labeled Designing, Building, Programming, Testing, Outreach, and Public Relations. Each member writes an entry regarding their work in the section that most accurately describes what they accomplished. Members can have numerous entries per day, as any member may have accomplished different tasks in various sections.
3. How do you find time to make sure everyone contributes?
    a. Our team finds the time to ensure everyone contributes by assigning them to their strengths. Members who are interested in CAD will be able to do so; programmers can work on autonomous. This allows members to enjoy their work and ensure they will revisit these tasks each meeting.