



PROJECT LEAD THE WAY

PLTW

Engineering Notebook

Name	<u>32430 A</u>	
Class	<u></u>	
Start	<u>8-22</u>	End <u>2-25</u>

Downloadable resources available at:
www.pltw.org/EngineeringNotebook

8-15

3 2 4 3 0 A

Team Members:

Javier Gonzales

Teresa

Diana

Marisol

Ayleen

Yareli

Luis

Oscar

Alonso

Janet

Design Statement

Design, build, and compete with a robot that can efficiently score all Vex game components in Vex's 2/25/2023 game in the zone.

Constraints

- Robot must be 18-18-18
- Vex materials only
- Must be able to score by February 2023
- Must have autonomous by February 2023
- Robot may use up to 8 motors

Strategies (match set up)

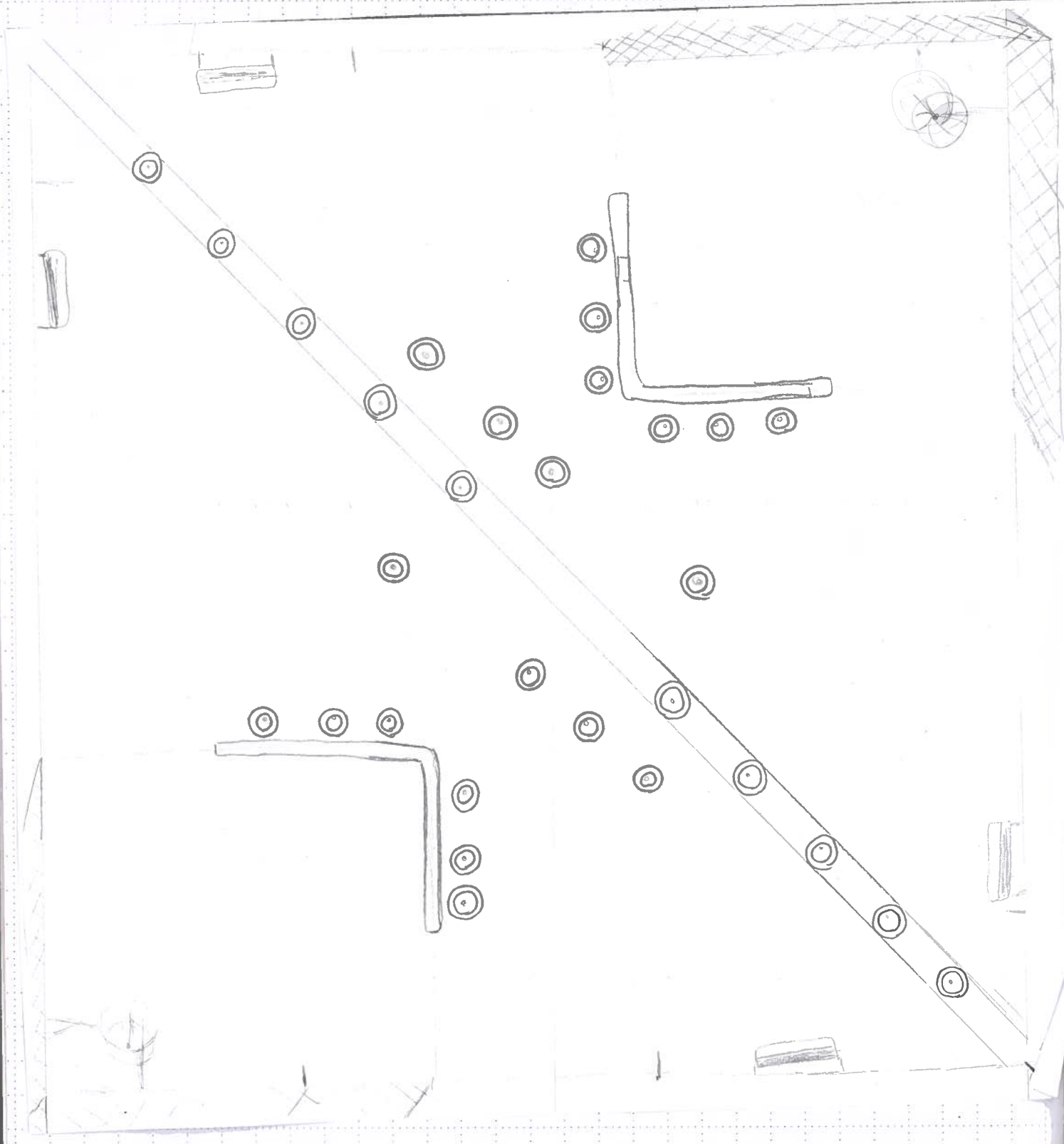
1. Pick up moveable goal
2. Stack multiple cones on moveable goal
3. Drag goal into 20pt Zone
4. Score all other cones onto stationary goal
5. End on parking tile

Signature: *Janet*

Date: 8/15

Team Members: *Janet, Oscar, Yareli, Ayleen, Marisol, Diana, Teresa, Luis, Alonso*Witness: *[Signature]*

Date: 8/15



Signature: *Fansen O'Brien*

Date: *4/15*

Team Members: *[faint handwritten names]*

Witness: *[initials]*

Date: *2/11/15*

General Game Rules

- Adults may assist students in urgent situations, but adults may never work on or program a robot without students on that team being present and actively participating.
- Students must be prepared to demonstrate an active understanding of their robots construction and programming to judges or event staff.
- At the beginning of a match, each robot must be smaller than a volume of 18" (457.2mm) long by 18" (457.2mm) wide by 18" (457.2mm) tall.
- Robots may not intentionally detach parts during the match or leave mechanism on the field.
- Each team must include Drive team members, program(s), Designer(s), and builder(s).
- During a match, each team may have up to three Drive team members.
- All rules still apply in the Autonomous period.
- A robot may not trap an opposing Robot for more than five seconds (0:05) during the driver controlled period.
- Robots may not expand beyond a horizontal area of 18" X 18" at any point during the match prior to the endgame.
- Robots may not have greater-than-momentary possession of more than three (3) discs at once.
- During the autonomous period, robots may not contact foam tiles, discs, or rollers which are on the opposing alliance's side of the autonomous line.
- Teams may not intentionally remove Discs from the field.

Signature: *Jessie O'Leary*Date: *8/15*

Team Members:

Witness:

*n*Date: *8/15*

Continued From Page #

Continued On Page #

8-14

Robot Rules

Certain non-VEX components are allowed

- Unlimited amount of rope/string, no thicker than $\frac{1}{4}$ " (6.35 mm)
- Pneumatic components with identical SMC manufacturer part to those listed on the VEX website.
- Give the radio some space, it must be mounted such that no metal surrounds the radio symbol.
- limited amount of custom plastic is allowed, can use part cuts from certain types of non-shattering plastic. It must be possible to have cut all of the plastic parts on the Robot from single 12" x 24" sheet up to 0.010" thick
- Limited amount of tape is allowed, to secure, label, cover, or prevent leaks
- Nut, washers, standoff, or non-threaded spacer up to 2.5" long
- Decorations are allowed as long as they do not affect robot performance in any significant way.
- Robots must ONLY use one VEX VS Robot brain
- Robots must only utilize the VEXnet system for all wireless robot communication
- Motors are limited, robots may only use up to 8 VS smart motors

Signature: Diana Espinoza

Date: 8/18/14

Team Members:

Witness:

Date: 8/16

Continued From Page #

Continued On Page #

Robot Rules

8-14

Certain non-VEX components are allowed

- Unlimited amount of rope/string, no thicker than $\frac{1}{4}$ " (6.35 mm)
- Pneumatic components with identical SMC manufacturer part to those listed on the VEX website.
- Give the radio some space, it must be mounted such that no metal surrounds the radio symbol
- limited amount of custom plastic is allowed, can use part cuts from certain types of non-shattering plastic. It must be possible to have cut all of the plastic parts on the Robot from single 12" x 24" sheet up to 0.070" thick
- Limited amount of tape is allowed, to secure, label, cover, or prevent leaks
- Nut, washers, standoff, or non-threaded spacer up to 2.5" long
- Decorations are allowed as long as they do not affect robot performance in any significant way.
- Robots must ONLY use one VEX VS Robot brain
- Robots must only utilize the VEXnet system for all wireless robot communication
- Motors are limited, robots may only use up to 8 VS smart motors

Signature:

Diana Espinoza

Date:

8/18/14

Team Members:

Witness:

Date:

8/14

Mechanical Analysis: In order to improve the efficiency of the robot, we decided to use gear ratios. By using the 84 & 36 tooth gears we were able to increase the power each motor provides to the wheels. Next we calculated the gear ratio & output torque

$$\frac{GR}{1} = \frac{n_{out}}{n_{in}} = \frac{84}{36} = 2.3$$

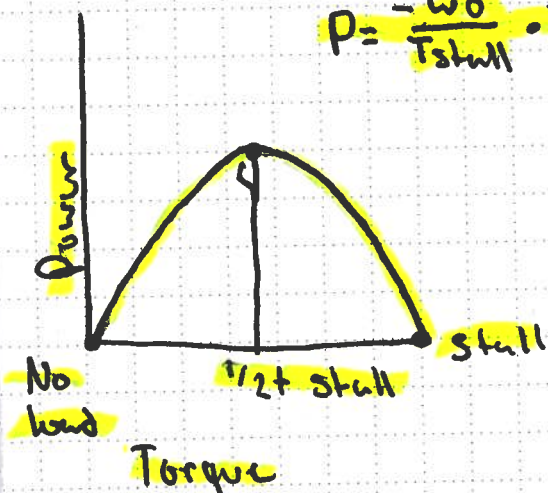
$$T_{out} = GR \cdot T_{in}$$

Next, we researched the input torque provided by the vix 2-wire 393 motor:

$$GR = \frac{\# \text{ of Driven Gear Teeth}}{\# \text{ of Driving Gear Teeth}}$$

According to the graph below:
Maximum Power at half stall torque

$$P = \frac{-W_0}{T_{stall}} \cdot T^2 + W \cdot T$$



The maximum power is provided at $1/2 T_{stall}$ of the motor therefore

$$T_{in} = \frac{1}{2} T_{stall} = \frac{14.76 \text{ lb-in}}{2} = 7.38 \text{ lb-in}$$

7.0v

• Finally we can conclude that:

$$T_{out} = GR \cdot T_{in} \rightarrow T_{out} = 2.3 (7.38)$$

$T_{out} = 16.97 \text{ lb-in}$ for every wheel.

Total of 67.97 lb-in for Robot

Signature:

Diana Espinoza

Date:

8/14

Team Members:

Witness:

R

Date:

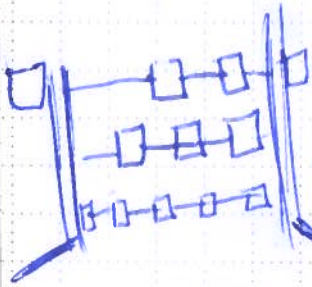
8/14

Intake:

8-20

Brainstorm #2

* 30A Flex wheels



- 3-inch top row x2
- 3-inch Mid row x3
- Freespinnings spacers used to lead disc up intake
- Motor connected to top row x2

* Note - Green cartridge 200 RPM SCALE: 240

Cons:

- Disc can get caught on c-channel
- ~~Disc~~ Disc gets stuck on midrow.
- Too much pressure on freespinnings spacers
- Flex reel does not secure disc properly
- Cannot reach roller.

Fix: Separate flex wheels (less pressure on freespinnings spacers)

- Include 4-inch flex to reach roller.
- 2-inch 30A's outside of C-channel to avoid disc getting stuck.

- Include 1x1 metal channels to guide disc

Signature:

Diana Espinoza

Date:

8/20

Team Members:

Witness:

Date:

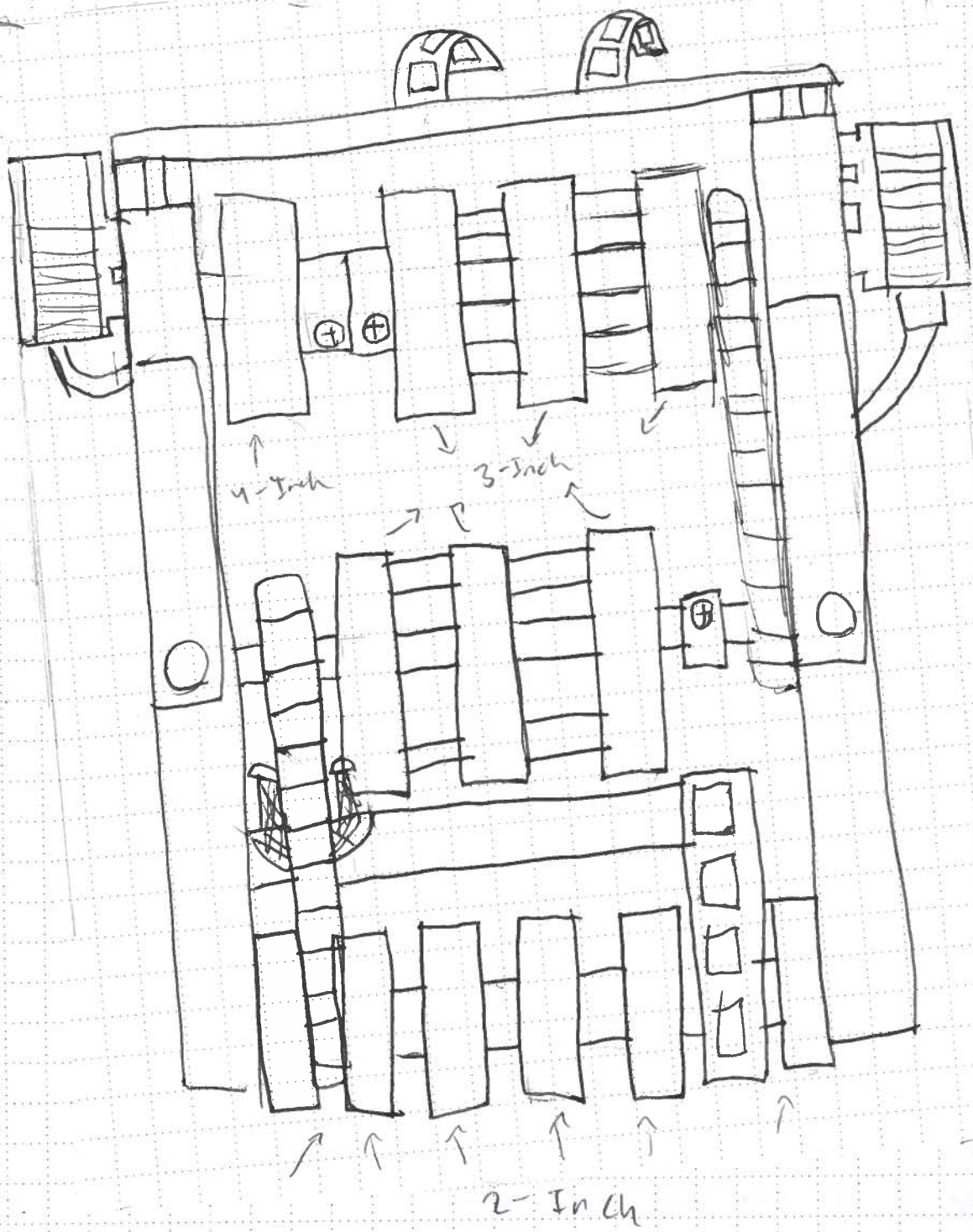
8/20

Continued From Page #

Continued On Page #

Final Desish

Metal 2x1



Signature: Diana Espinoza

Date: 8/20

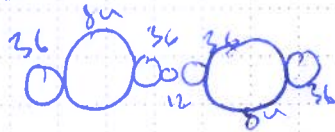
Team Members:

Witness: [Signature]

Date: 8/20

Continued From Page #

Continued On Page #

Chassis 1st Design8-27Drive train
wheel

- omni wheels
- Green cartridge

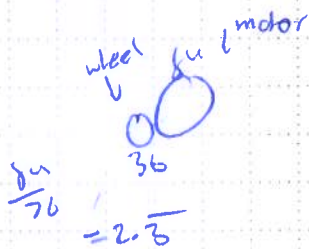
Gear ratio

$$\frac{84}{36} = 2.3\bar{3}$$

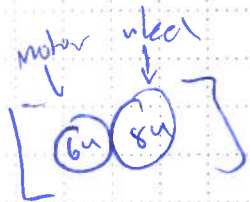
8-29

Chassis 2nd Design

- Mecanum wheel
- Drives all axes

8-31

Chassis 3rd Design (Final Design)



$$\frac{64}{84} = 0.76$$

- Very Strong
- Still fast

- Isolated Motor System - 4-motor drive
~~the~~ NOT connected Drive train

Signature: Valentin Medel

Date: 8/22

Team Members:

Witness:

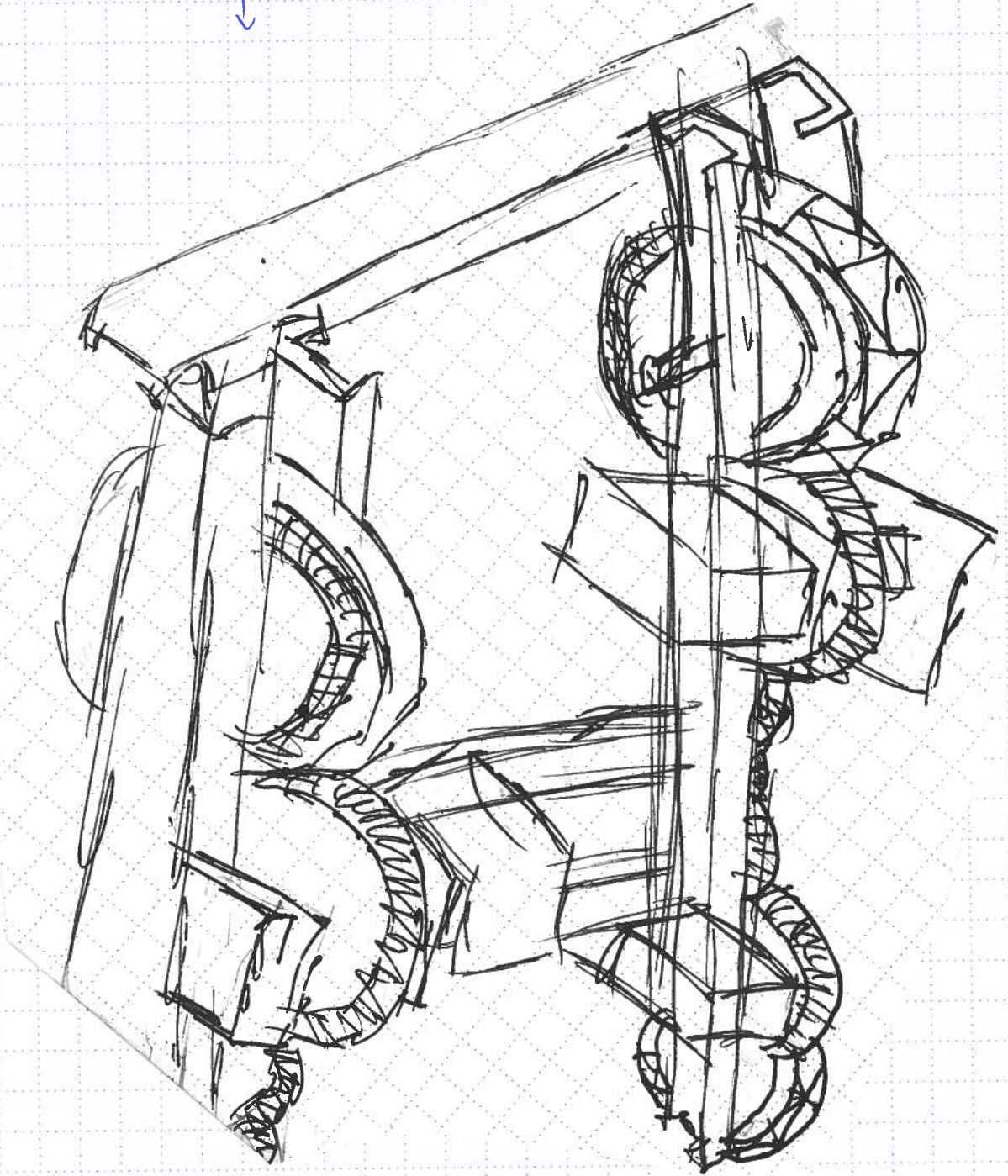
Date: 8/22

Continued From Page #

Continued On Page #

1st Design
↓

8-56



Signature: *Valencia Medel*

Date: *8/22*

Team Members:

Witness: *[Signature]*

Date: *8/22*

Continued From Page #

Continued On Page #

8/22-26

August 22

Team: Team member selection, team leads selection (complete competition survey, team lead selection)

Builders: Teresa, Diana, Oscar, Luis

Program: Marisol, Ayleen, Alonso

Designers: Javier, Yareli, Janet



Schedule: Meeting schedule setup (Meetings on which weekdays?)

Sketches: Complete online research (links above, find other sources) and start to develop sketches in the engineering notebook of robot parts

On page # 7-9 we have the chassis
On page #
On page #

3-D model: Use Autodesk Fusion on laptop or Desktop to start working on the robot 3D model (Link to previous competition CAD files)

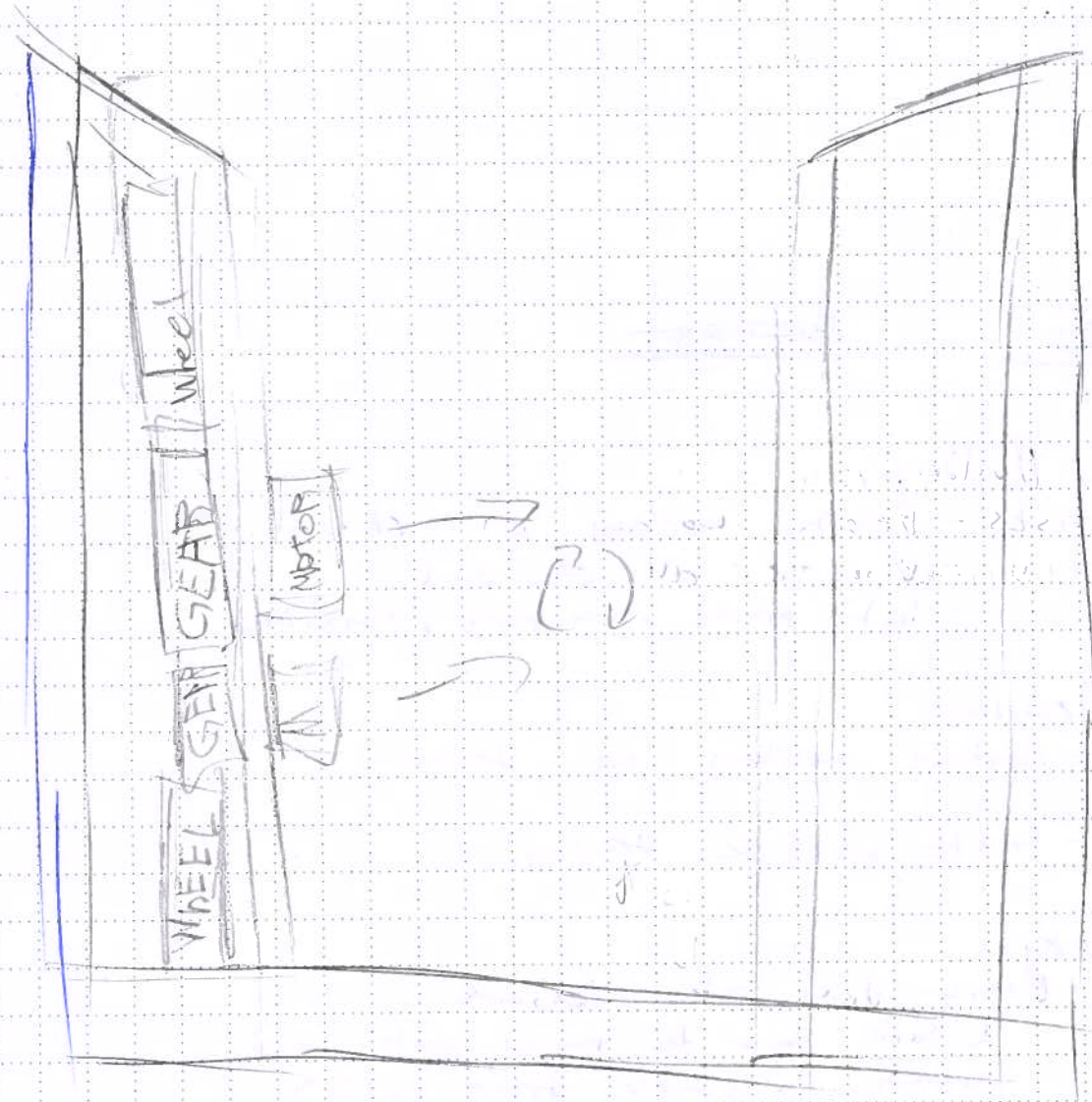
Game strategies: Develop initial game strategies (Link to previous game strategies document)

Signature: 	Date: 8/22	Team Members:
Witness: 	Date: 8/22	
Continued From Page #		Continued On Page #

8-26-8-31

Parts list: Complete and submit parts and custom parts list

Chassis: Robot chassis/drives building



Signature:

Date:

8/26

Team Members:

Witness:

Date:

8/26

Continued From Page #

Continued On Page #

September

9-2

Individual Parts Individual robot parts building (work on building, sketches and pictures of the individual parts):
collection system, lifting system, shooting system

Sketches: Complete sketches of parts

3D Model: Use Autodesk Fusion on laptop or Desktop to continue working on the robot 3D model

~~Builders:~~~~Builders:~~

- ~~Builders:~~
- ~~Builders:~~
- ~~Builders:~~
- ~~Builders:~~
- ~~Builders:~~

Builders:

- Begin working on chassis
- Organize all equipment
- test brains, motors, controllers

Designers:

- Continue working on design
- Create multiple designs.

Coders:

- Review Vex code lessons
(learn how to name parts and create a simple drive code)

Signature:



Date:

9/2

Team Members:

Witness:



Date:

9/2

Continued From Page #

Continued On Page #

October

10-2

Part list: complete and submit parts and custom parts list (if needed)

Chassis: Robot chassis building (work on building, sketches and pictures of the chassis)

Individual parts: Individual robot parts building

Sketches: Complete sketches of parts

3D Model: Use Autodesk Fusion on laptop or desktop to continue working on the robot 3D Model

Robot Assembly: Start to assemble the robot parts on the chassis

Signature:

Date:

10/2

Team Members:

Witness:

Date:

10/2

Continued From Page #

Continued On Page #

11/2

November

Part list: complete and submit parts and custom parts list (if needed)

Individual parts: Individual robot parts building

Sketches: complete sketches of parts

3D Model: Use Autodesk Fusion on laptop or Desktop to continue working on the robot 3D model.

Robot Assembly: Assemble the robot parts on the chassis

Code: Start working on the robot code (links above, find other sources) to develop both the autonomous and remote control code

Regional Competition Registration: Select competition for Region 2

Signature:



Date:

11/2

Team Members:

Witness:



Date:

11/2

Continued From Page #

Continued On Page #

12-2

December.

Parts list: complete and submit parts and custom parts list (if needed)

Individual parts: Individual robot parts building

Sketches: Complete sketches of parts

3D Model: Use Autodesk Fusion on laptop or Desktop to continue working on the robot 3D model

Robot Assembly: Assemble the robot parts on the chassis

Code: start working on the robot code (links above, find other sources) to develop both the autonomous and remote control code

Signature:



Date:

12/2

Team Members:

Witness:



Date:

12/2

Continued From Page #

Continued On Page #

Sketches: Complete sketches of robot

January:

PL

3D Model: Use Autodesk Fusion on laptop or Desktop to continue working on the robot 3D model

Robot Assembly: Final Adjustments on robot

Code: Complete robot code

Game Strategies: Review/update game strategies

Signature:

Date:

1/12

Team Members:

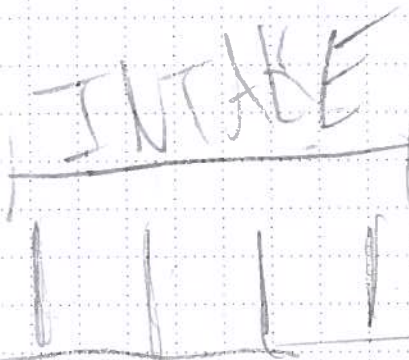
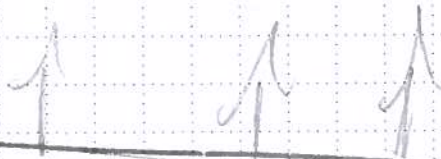
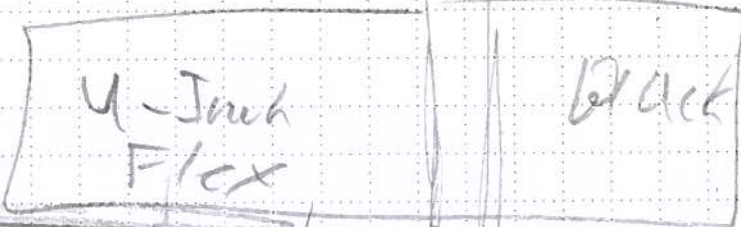
Witness:

Date:

1/12

Continued From Page #

Continued On Page #



3 stick
Disk

5.5
Inch

EXP

Signature:

Date:

1/12

Team Members:

Witness:

Date:

1/12

Continued From Page #

Continued On Page #

Practice: Practice game strategies

February: 2-2

Permission Slip: Sign/turn in permission slip and VEX waiver

Final adjustments: Double autonomous code
 License Plate placement on robot
 Shooter part update (add more string)
 Disk indexer/stack experimentation

Interview Preparation: Prepare for the interview with the judges
 (View Previous questions and answers)

Checklist: Complete final checklist

VEX Robotics Regional Qualification: Attend Competition

Survey: Complete post competition survey

State competition registration: Register for state competition

VEX Robotics State Qualification: Attend Competition

Survey: Complete post competition survey

Signature: 

Date: 2/2

Team Members: 

Witness: 

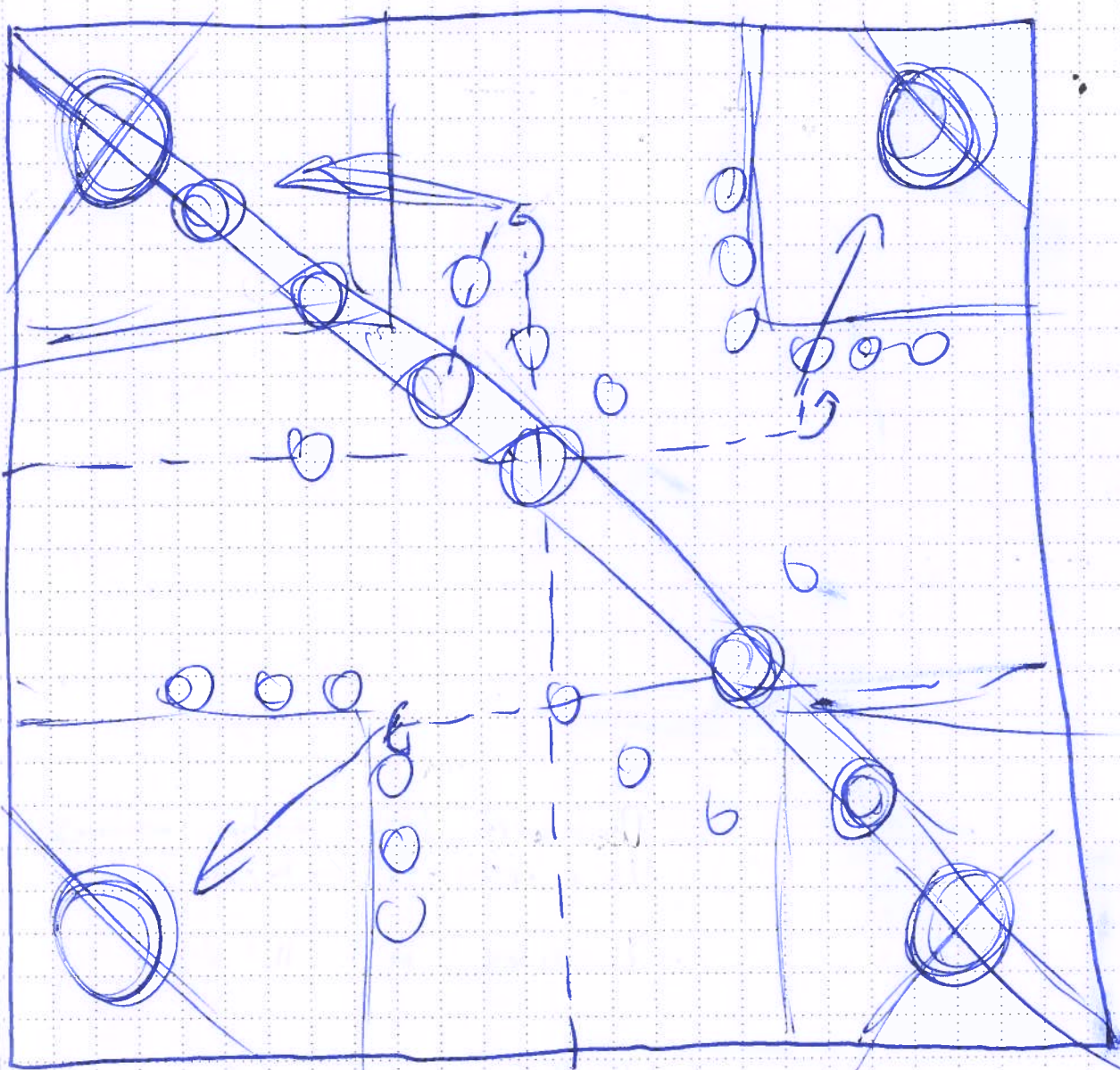
Date: 2/2

Continued From Page #

Continued On Page #

Autonomous Struts

2-5



Signature:

Date:

2/5

Team Members:

Witness:

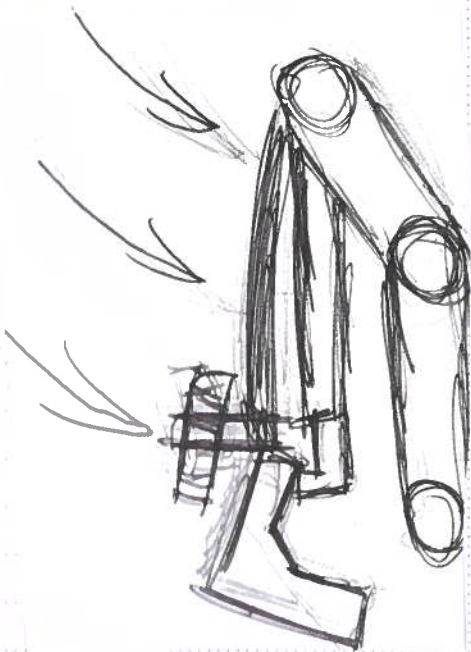
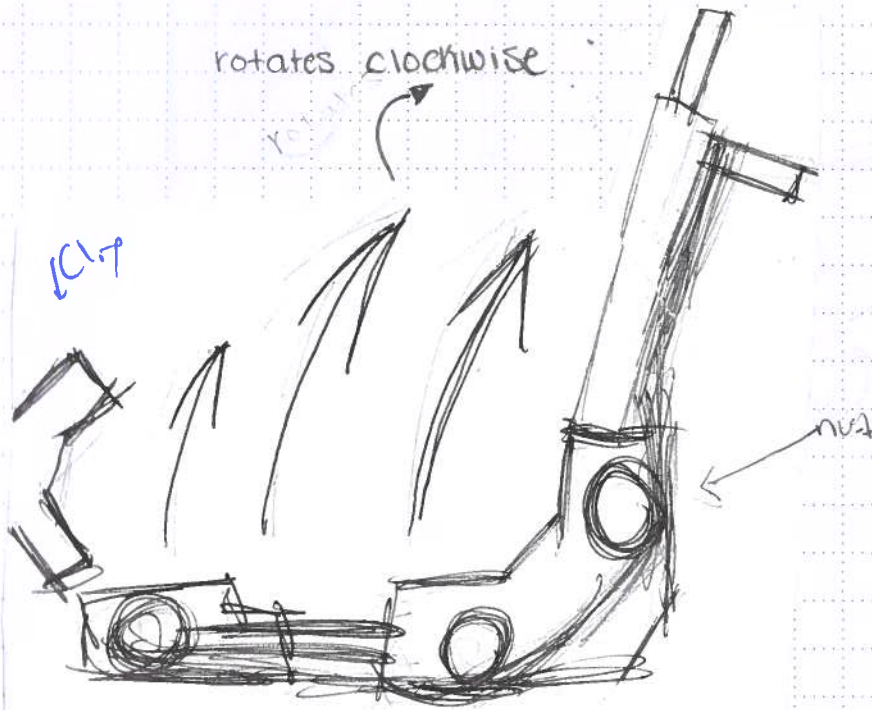
Date:

2/5

Continued From Page #

Continued On Page #

Pneumatres! Brown Storm



• Downward force acting against
clip, releasing → input

- Launches nut 11 + feet

- 100 PSI res for 2
cut a cut

Signature:

Date:

2/5

Team Members:

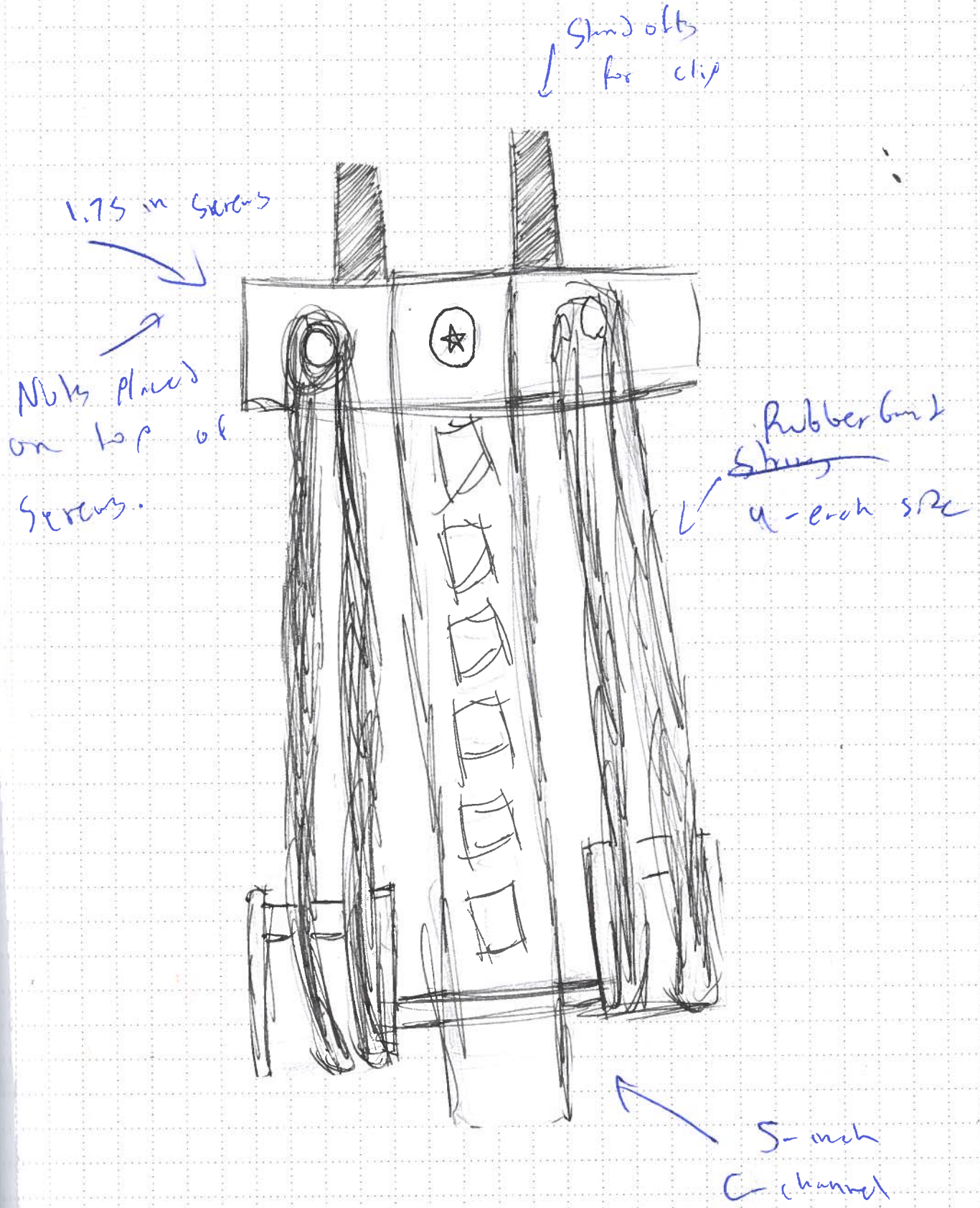
Witness:

Date:

2/5

Continued From Page #

Continued On Page #



Signature:

Date: 2/5

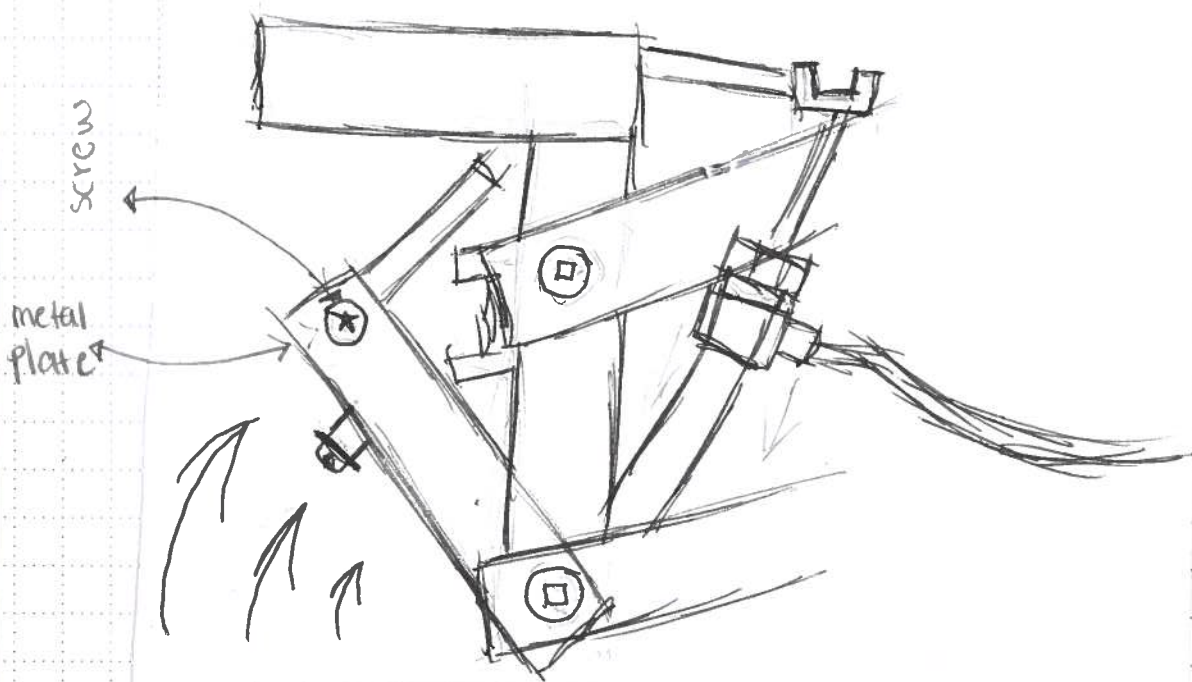
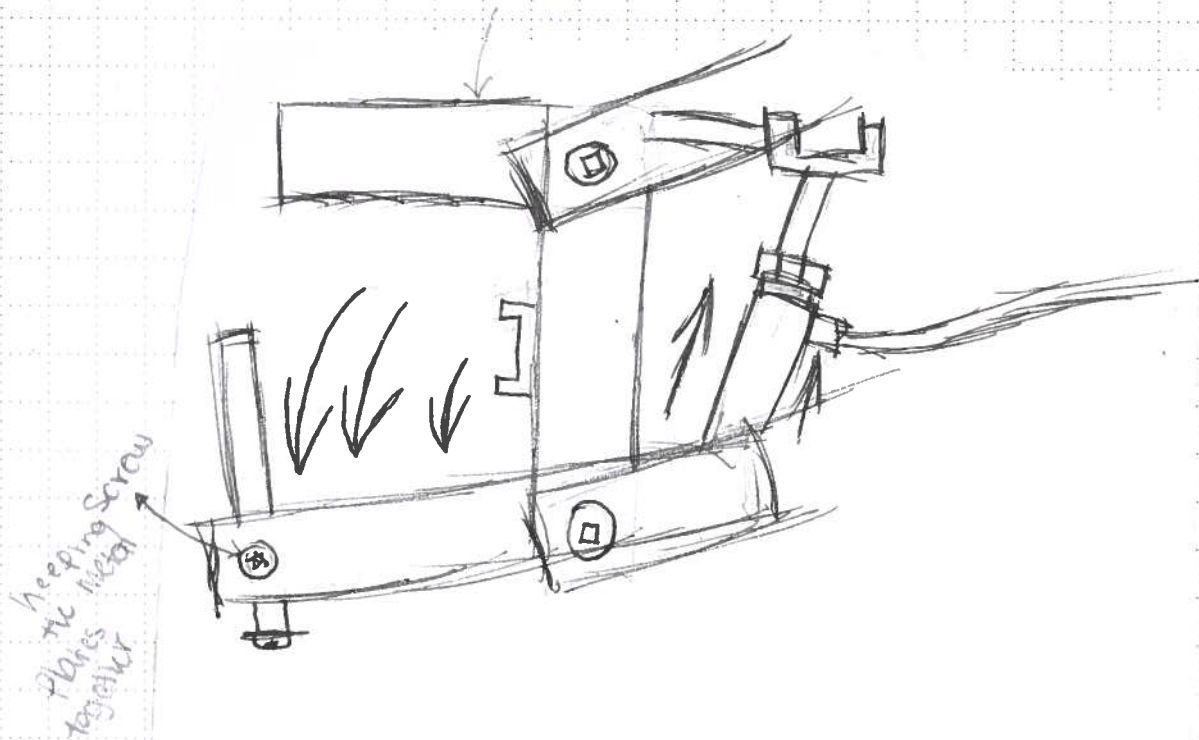
Team Members:

Witness:

Date: 2/5

Continued From Page #

Continued On Page #



Signature:

[Handwritten signature]

Date:

2/5

Team Members:

Witness:

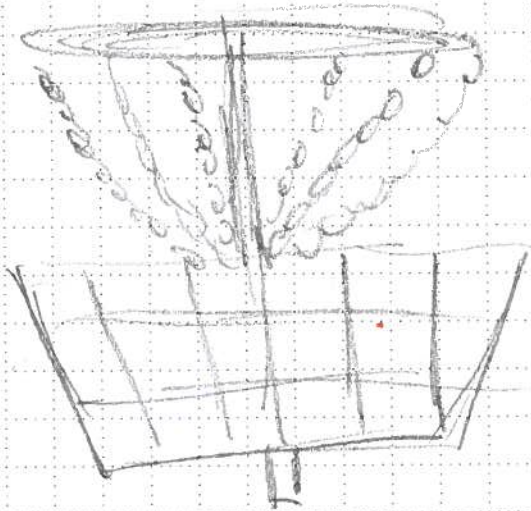
[Handwritten mark]

Date:

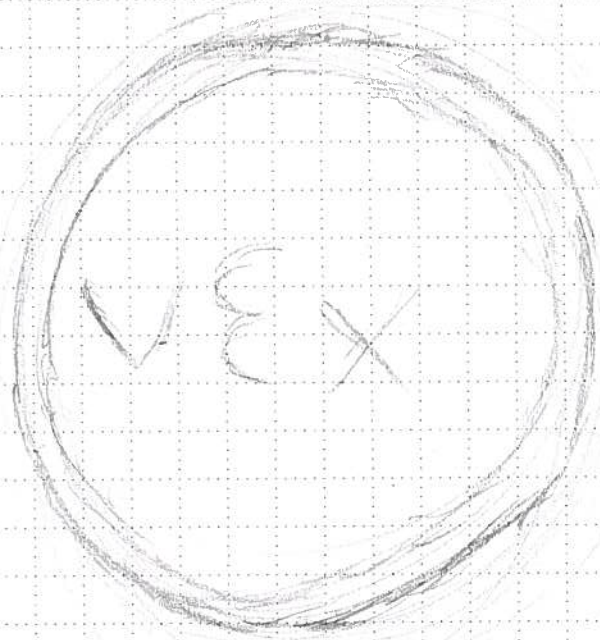
2/5

Continued From Page #

Continued On Page #



Thickness: 0.79
radius: 2.29 in
outside diameter: 4.58 in
inside diameter: 2.98 in



Signature:

Date:

4/5

Team Members:

Witness:

Date:

2/5

Continued From Page #

Continued On Page #