ENGINEERING DESIGN PROCESS

ASK
(1A) Problem Statement
(1B) Customer Interview
(1C) Criteria & Constraints

RESEARCH
(2A) Research Notes
(2B) Source Citations

IMAGINE
(3A) Idea List
(3B) Sketches & Details

PLAN
(4A) Decision Matrix TEMPLATE
(4B) CAD Layout
(4C) Bill of Materials ("BOM")
(4D) DESIGN BRIEF TEMPLATE

CREATE
(5A) PROTOTYPE
(5B) Documentation

TEST
(6A) Testing Protocols
(6B) Test Results Table

IMPROVE/ COMMUNICATE
(7A) Engineering Presentation
(7B) "How I Made This" VIDEO

Use these **EDP #'s** on your daily entry slides

1-CLICK HERE
2-ADD NEW SLIDE
at TOP

REVERSE DATE ORDER

RECORD at TOP of EVERY SLIDE:

Project ,EDP #, Name,Date

Notes - Annotated Photos/Videos - Data - Sketches *("INSERT" > TextBox, Image, Video, Line)*

My Home-School Workspace

By: Aiden Pritchett

Notes - Annotated Photos/Videos - Data - Sketches *("INSERT" > TextBox, Image, Video, Line)*

- (1A) Problem Statement: I need to create a homeschool workspace that is quiet and away from distractions.
- (1B) Criteria: My homeschool workspace needs to have a computer and it needs to be quiet and away from distractions.
- (1C) Constraints: I need a computer, computer cord, a workspace, flexible style seating, work lamp, work lamp cord, and a pencil holder and a drawer.

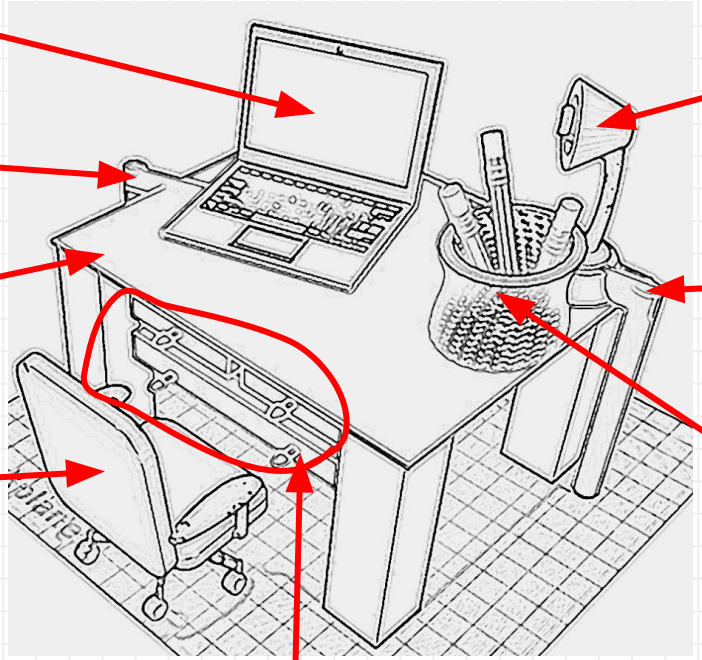
Notes - Annotated Photos/Videos - Data - Sketches *("INSERT" > TextBox, Image, Video, Line)*

Computer cord

Flexible style seating

Work lamp, computer, workspace, pencil holder, and a drawer

Notes - Annotated Photos/Videos - Data - Sketches *("INSERT" > TextBox, Image, Video, Line)*



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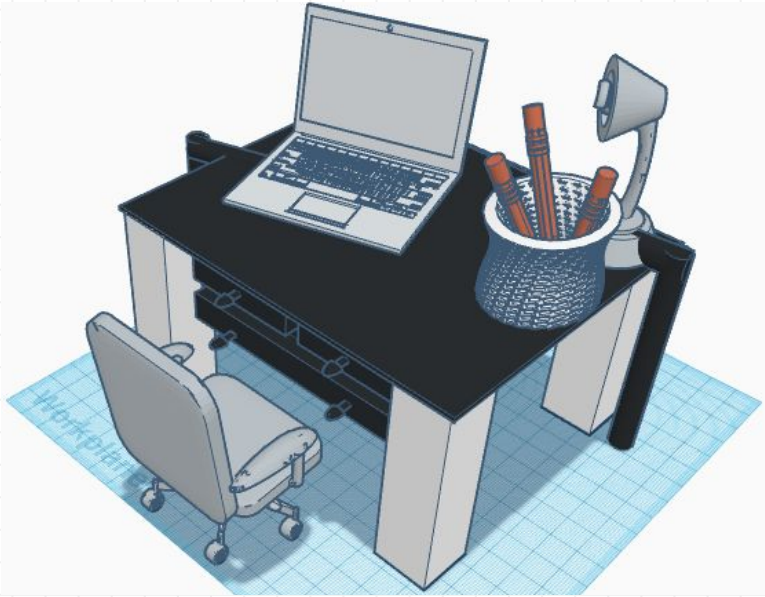
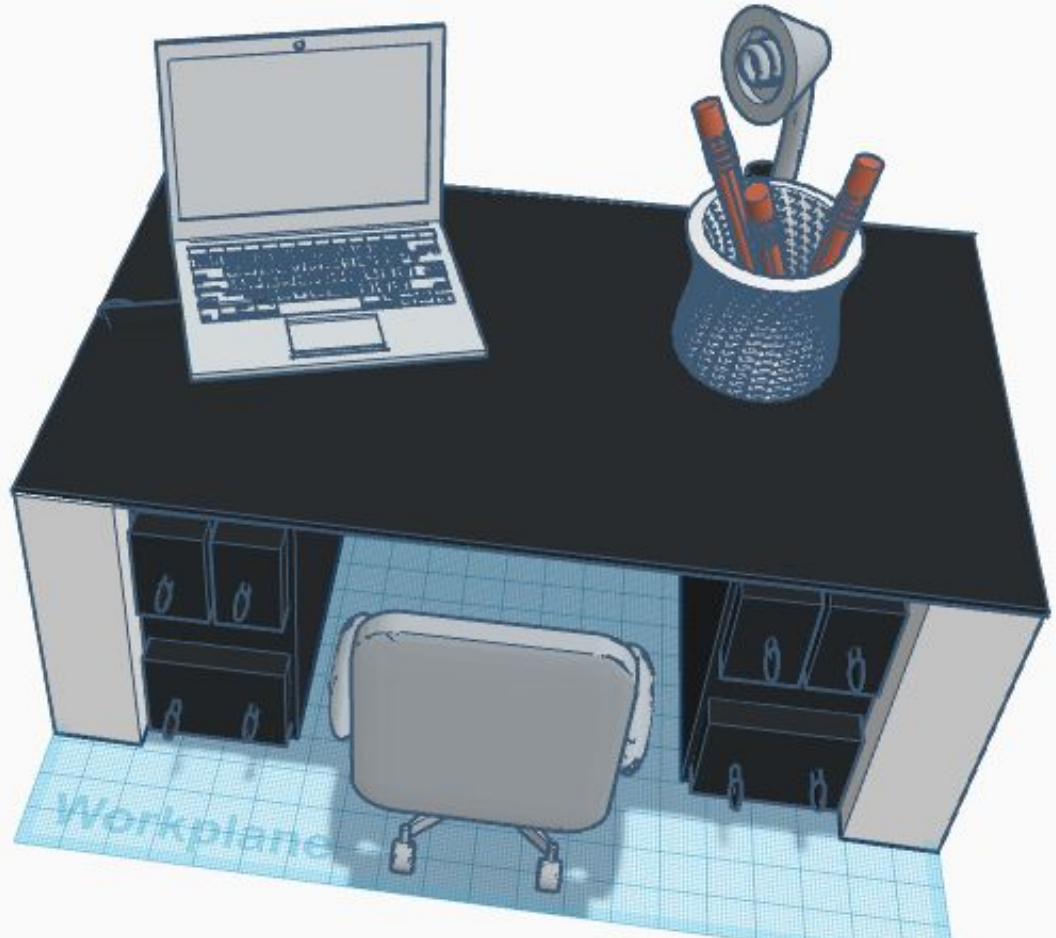


Bill of Materials (BOM)

(for all project items to be purchased, or provided even at no cost)

Project Name:	*My Homeschool Workspace*					*Date:*	*4/10/2020*
Project Team:	*Aiden Pritchett*						
Date Needed	*Vendor / Store (could be You or Ha*	*Item Number*	*Item Description (might want to detail is for specific "idea" for project)*	*Unit (each, 3-pack, etc)*	*Quantity*	*Cost per Unit*	*Subtotal*
4/10/2020	*Home Depot*	*6005*	*6 in. Solid Pine Finish Parsons Leg*	*ea*	*4*	*$3.96*	*$15.84*
4/10/2020	*Home Depot*	*4922904*	*Soft-Touch Gooseneck LED Task Lamp With USB Charging P*	*1-pack*	*1*	*$15.80*	*$15.80*
4/10/2020	*Best Buy*	*8LK78UA#ABA*	*HP ENVY x360 - 15-dr1022nr*	*1-pack*	*1*	*$1,049.99*	*$1,049.99*
4/10/2020	*Lowes*	*847049*	*Live Edge Natural Wood Pine Rectangle Coffee Table Top (Ac*	*ea*	*2*	*$59.95*	*$119.90*
4/12/2020	*Office Depot*	*394311*	*Rolodex® Wood Tones™ Pencil Holder, Mahogany*	*1-pack*	*1*	*$12.99*	*$12.99*
4/12/2020	*Lowes*	*2985*	*edsal Putty 5-Drawer File Cabinet*	*1-pack*	*1*	*$857.53*	*$857.53*
4/12/2020	*Lowes*	*1431509*	*Flash Furniture White Contemporary Executive Chair*	*1-pack*	*1*	*$187.00*	*$187.00*
					TOTAL COST =		*#REF!*

Notes - Annotated Photos/Videos - Data - Sketches *("INSERT" > TextBox, Image, Video, Line)*



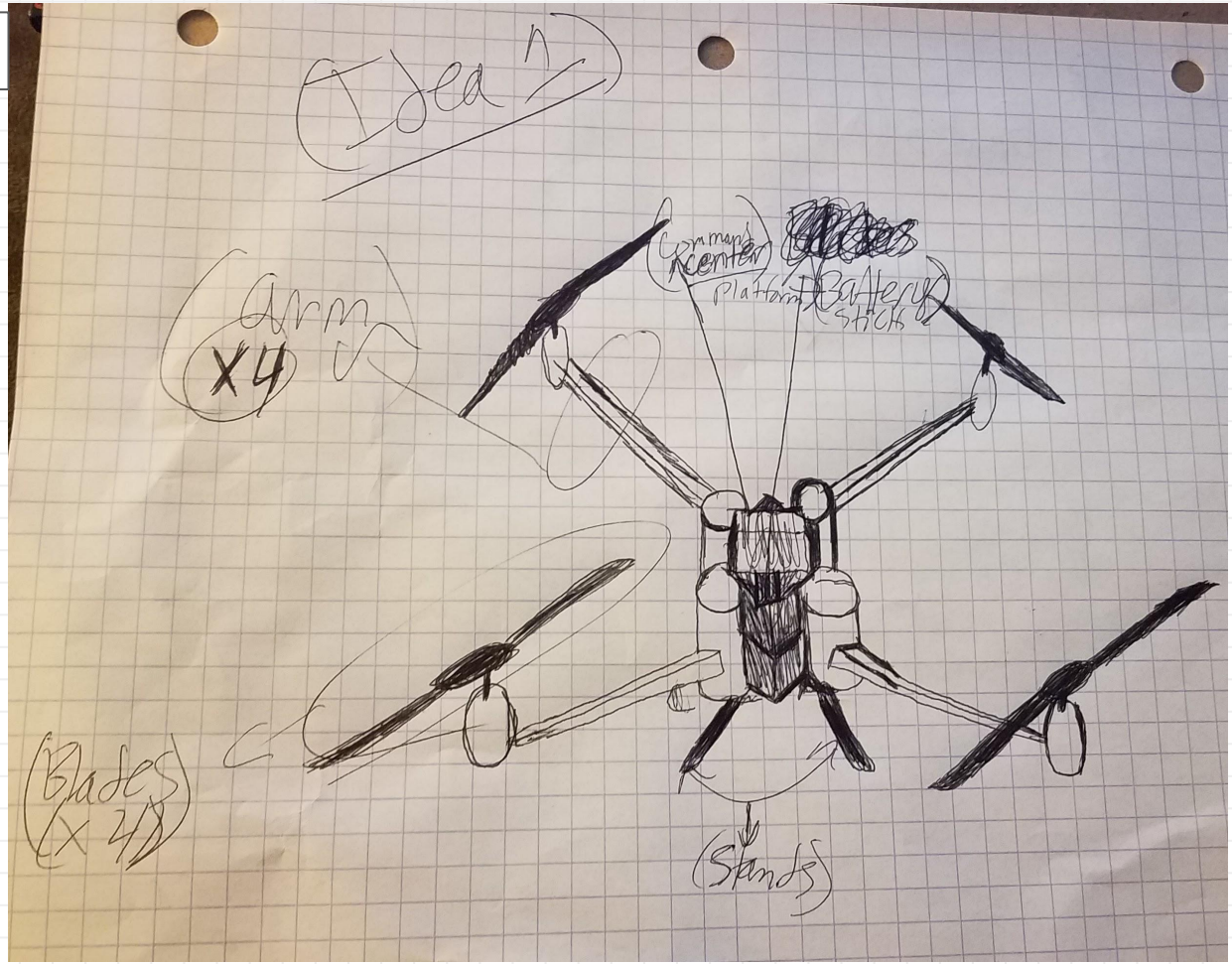
I will build a two-cabinet office next time because the cabinet under the table top didn't allow me to get my knees under the table.

Notes - Annotated Photos/Videos - Data - Sketches *("INSERT" > TextBox, Image, Video, Line)*

- (1A) Problem statement: I need to build a quadbot drone that can hover above the ground.
- (1B) Getting advice from other people.
- (1C) Constraints: Battery, Propellers (x4), Leg Stands, and Motor and Command Center.

Notes - Annotated Photos/Videos - Data - Sketches *("INSERT" > TextBox, Image, Video, Line)*

- (2A) Contest is open to entries from US, Canada [excluding Quebec], UK, China, Belgium, the Netherlands, Australia, Colombia, Germany, Switzerland, Norway, India, New Zealand, and Denmark.
- (2B) https://www.instructables.com/contest/drones2013/


Idea 1
Arm
x4
Command Center
Platform
Battery
Sticks
(Blades)
(x 4)
(Stands)

DECISON MATRIX

Design Criteria (attributes on which you compare Ideas)	Relative Weight (% or 1,2…)	Idea 1: Design 1		Idea 2: Design 2		Idea 3: Design 3	
		Your Rating	Score (weight * rating)	Your Rating	Score (weight * rating)	Your Rating	Score (weight * rating)
Cost of parts	10%	1	0.1	2	0.2	3	0.3
Time to build	90%	10	9	11	9.9	12	10.8
Durability	100%	10	0.1	11	0.11	12	0.12
System Integration	100%	10	0.1	11	0.11	12	10
Efficiency	99%	9	9.5	10	10	11	10.89
TOTALS			18.8		20.32		32.11

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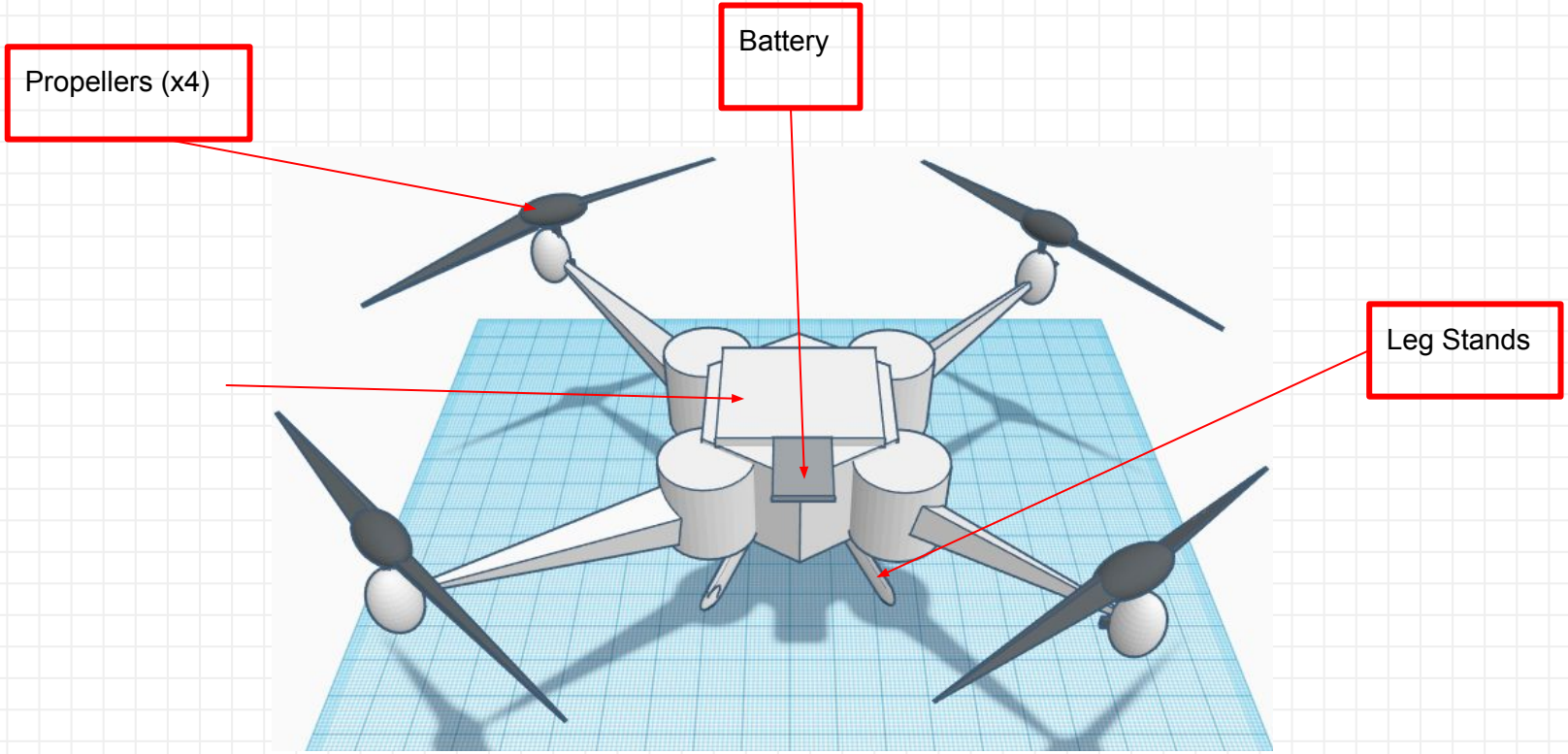

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1. Frame – $16
2. Motors – $27
3. ESC – $30
4. Flight controller – $20
5. FPV Camera – $20
6. Video transmitter – $12
7. Receiver – $13
8. 10 pairs of props – $7

Total: $145

Engineering Notebook

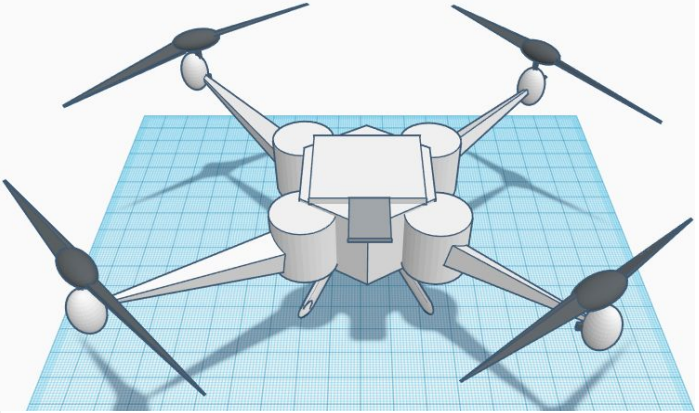
Project Name: *PLAN*

EDP #: 4D

Name: *Aiden Pritchett*
Page: 1 **Date:** *1/27/20*

DESIGN BRIEF

(consider a multi-column layout with text & images)



- Client: Dr. Harty
- Designer: Aiden Pritchett
- Problem statement: I need to build a quadbot drone that can hover above the ground.
- My design statement is to design a quadbot that has enough propellent force to lift the weight of the quadbot off the ground
- Constraints: Battery, Propellers (x4), Leg Stands, and Motor and Command Center.

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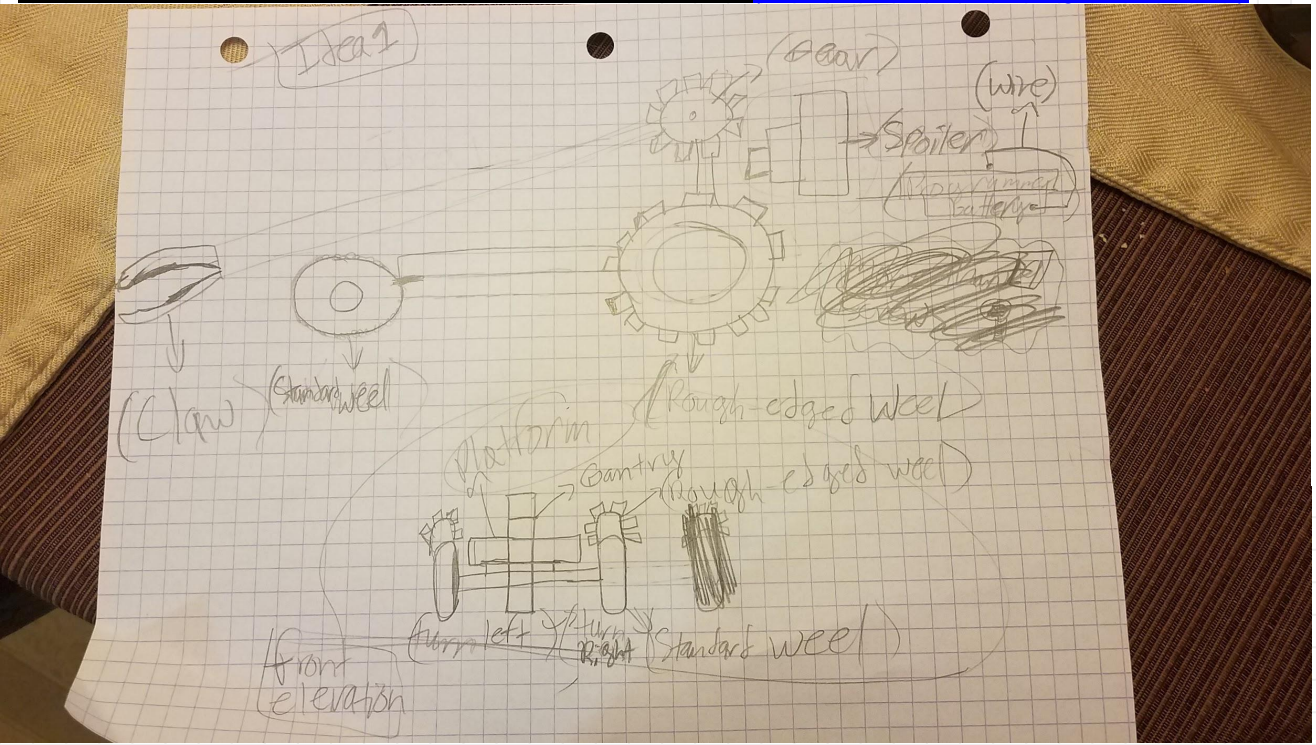
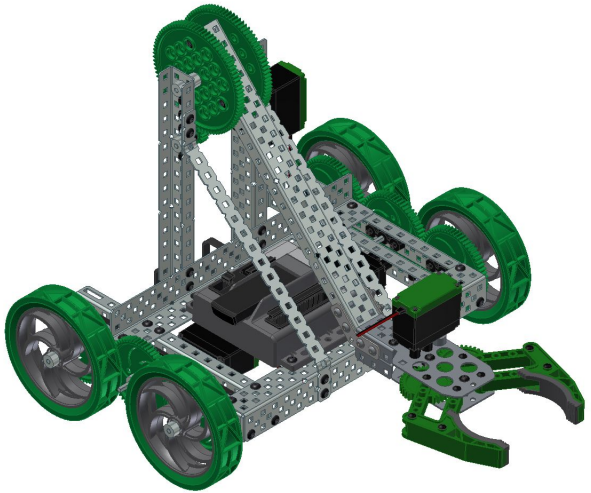
- (1A) Problem Statement:
  - The name of the game is to build a robot that can lift and deliver the most amount of blocks without the battery draining rapidly. Each cube weighs 285 grams (~0.63 lbs.).
- (1B) Customer Interview:
  - Getting someone else's input.
- (1C) Criteria and Constraints:
  - My clawbot must be able to lift a cube that weighs 285 grams (~0.63 lbs.).
  - My clawbot needs to weigh more than 285 grams.

Notes - Annotated Photos/Videos - Data - Sketches *("INSERT" > TextBox, Image, Video, Line)*

- Materials that are needed to build my clawbot: Vex battery holder, Vex motor, Rough-edged wheel (2), Standard wheel (2), Vex claws, Vex metal, Vex gears, Vex programming device, Cube weighs 285 grams (~0.63 lbs.).
- (2B) **https://www.vexrobotics.com/vexedr/competition/vrc-current-game**

Notes - Annotated Photos/Videos - Data - Sketches *("INSERT" > TextBox, Image, Video, Line)*





- The reason why I chose a claw mechanism is that it allows me to pick up a cube and put it into my goal and I can also stack them into towers.

DECISON MATRIX

Design Criteria (attributes on which you compare Ideas)	Relative Weight (% or 1,2…)	Idea 1: Design 1		Idea 2: Design 2		Idea 3: Design 3	
		Your Rating	Score (weight * rating)	Your Rating	Score (weight * rating)	Your Rating	Score (weight * rating)
Cost of parts	10%	1	0.1	2	0.2	3	0.3
Time to build	90%	10	9	11	9.9	12	10.8
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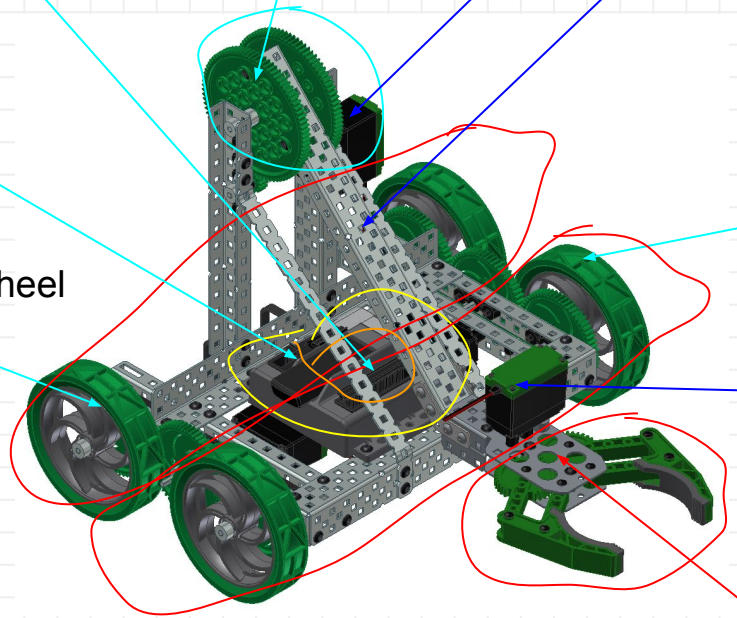
System Integration	100%	10	0.1	11	0.11	12	0.12
Efficiency	99%	9	8.91	10	9.9	11	10.89
TOTALS			18.21		20.22		22.23

Notes - Annotated Photos/Videos - Data - Sketches *("INSERT" > TextBox, Image, Video, Line)*

- Motor
- Gears (2)
- Battery holder
- Metal
- Programming device
- Standard wheel (2)
- Rough-edged wheel (2)
- Motor
- Claws



Notes - Annotated Photos/Videos - Data - Sketches *("INSERT" > TextBox, Image, Video, Line)*

Clawbot Kit= $169.99

Total Price of all resources

Motion(3) 2-Wire Motor 393
(4) 2-Wire Motor 393 High Speed Gear Sets
(1) Claw Kit Assembly (includes motor)
(21) Shaft Collar
(4) Shaft Coupler
(8) Shaft, 3" Long
(18) Bearing Flat
(2) Spur Gear, 12-tooth
(6) Spur Gear, 60-tooth
(2) Spur Gear, 84-tooth
(4) 4" Wheel

Equipment(2) Tool, Hex Key (5/64")
(2) Tool, Hex Key (3/32")
(2) Tool, VEX Open-Ended Wrench
(1) Quick Start Guide, Clawbot

Metal(2) Bar, 20-hole
(2) Chassis Bumper (20-hole)
(4) Chassis Rail (16-hole)
(2) C-Channel, 1x2x1x15 hole
(1) C-Channel, 1x2x1x20 hole

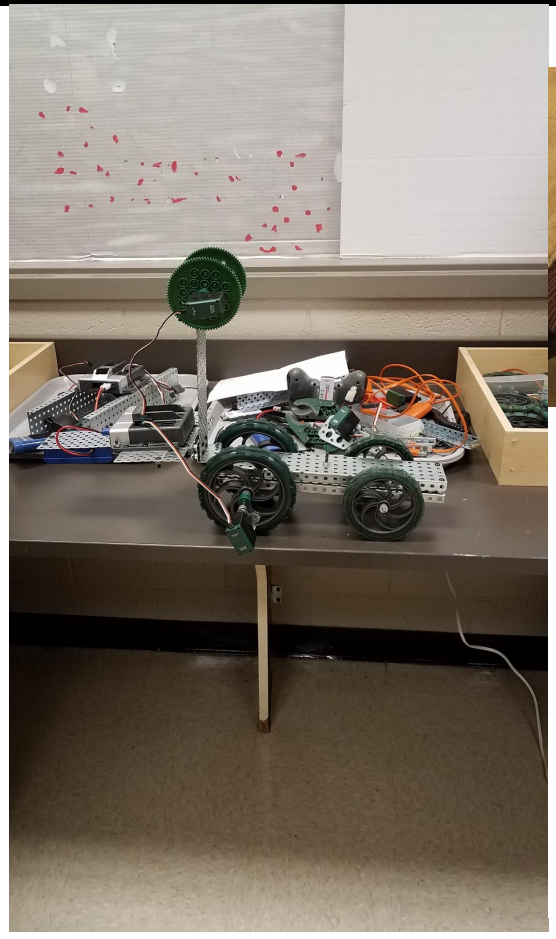
Hardware(32) Screw, 8-32 x 1/4" Long
(14) Screw, 8-32 x 1/2" Long
(3) Screw, 8-32 x 1 1/2" Long
(6) Locking Screw, 6-32 x 1/4" Long
(6) Locking Screw, 6-32 x 1/2" Long
(42) Nut, 8-32 Keps
(2) Nut, 8-32 Nylock
(6) Shaft Spacer, Thin (4.6mm)
(50) 4" Tie Wraps
(32) Bearing Attachment Rivet
(1) Standoff 1.00"

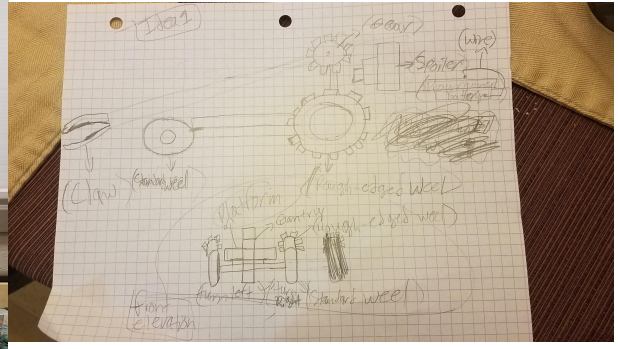
Electrical(2) Motor Controller 29
(1) Battery Strap (2-pack)

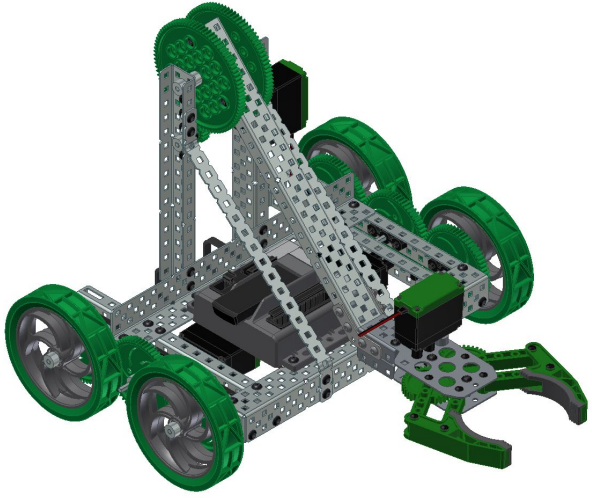
Equipment(2) Tool, Hex Key (5/64")
(2) Tool, Hex Key (3/32")
(2) Tool, VEX Open-Ended Wrench
(1) Quick Start Guide, Clawbot

DESIGN BRIEF

(consider a multi-column layout with text & images)



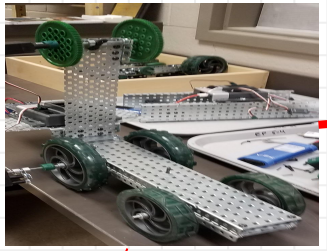




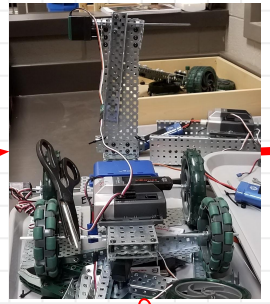
- Client: Dr. Harty
- Designer: Aiden Pritchett
- Problem statement: I need to build a robot that can pick up a cube that is 285 grams (~0.63lbs.) without dropping it.
- My design statement is to design, build, and test a robot that can grab cubes that are 285 grams (~0.63lbs.) and stack them in goals or into towers.
- Constraints: Vex battery holder, Vex motor, Rough-edged wheel (2), Standard wheel (2), Vex claws, Vex metal, Vex gears, Vex programming device.

Notes - Annotated Photos/Videos - Data - Sketches *("INSERT" > TextBox, Image, Video, Line)*

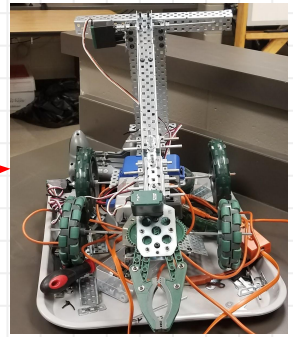
Original Prototype



Changes Were Being Made

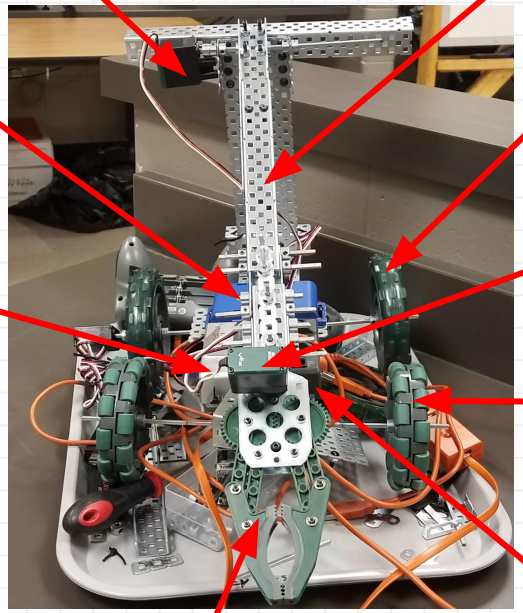


What My Prototype Looks Like Now



Notes - Annotated Photos/Videos - Data - Sketches *("INSERT" > TextBox, Image, Video, Line)*

- Motor
- Wired Connectors
- Metal
- Battery holder
- Rough-edged wheel (2)
- Motor
- Programming device
- Standard wheel (2)
- Motor
- Claws



Notes - Annotated Photos/Videos - Data - Sketches *("INSERT" > TextBox, Image, Video, Line)*

1A:

- ***I need to build a rocket that will reach the furthest distance among my peers.***

1B:

- ***All of the rockets will be launched; the person with the rocket that went the furthest will be the the winner.***

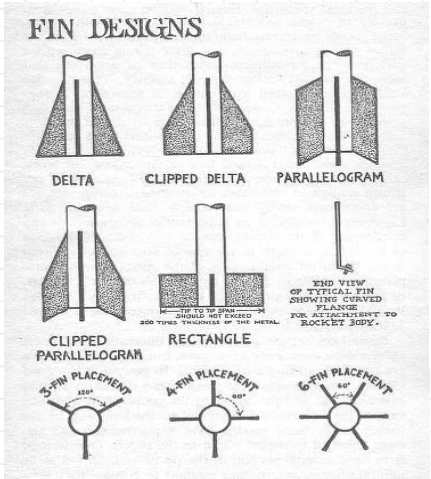
1C:

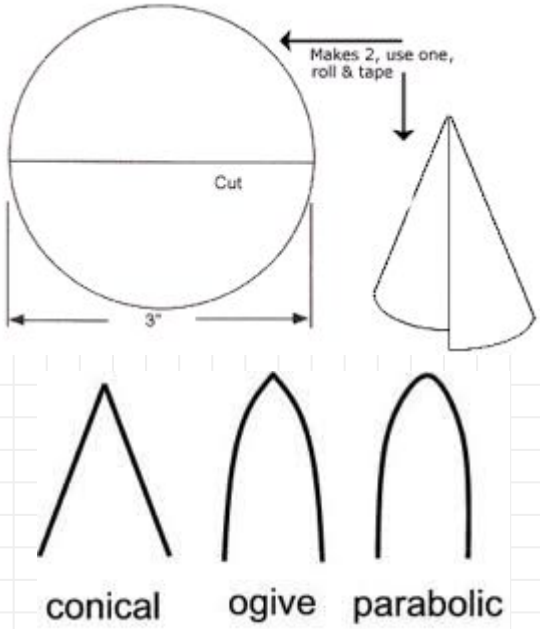
- ***Resources that must be used paper, tape, and paper clip.***

Notes - Annotated Photos/Videos - Data - Sketches *("INSERT" > TextBox, Image, Video, Line)*

- ***https://www.youtube.com/watch?v=r7RIgo-KTGs***

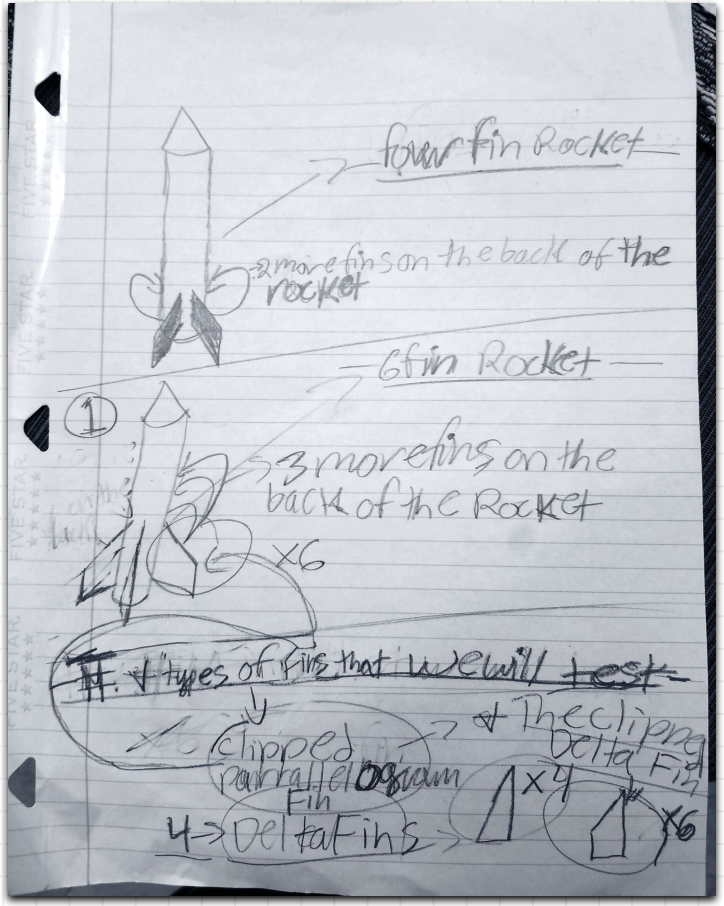
Designs





Nose Cones

Notes - Annotated Photos/Videos - Data - Sketches *("INSERT" > TextBox, Image, Video, Line)*



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Design Criteria	Weight	Soln. A		Soln. C	
		Rating	Weight Scoring	Rating	Weight Scoring
Distance	100%	5	5	5	25
Thickness	95%	4	3.8	4	15.2
Lightweight	100%	5	5	5	25
Durability	100%	5	5	5	25
Heavyweight	100%	5	5	5	25
Totals (Highest is top solution)			23.8		115.2

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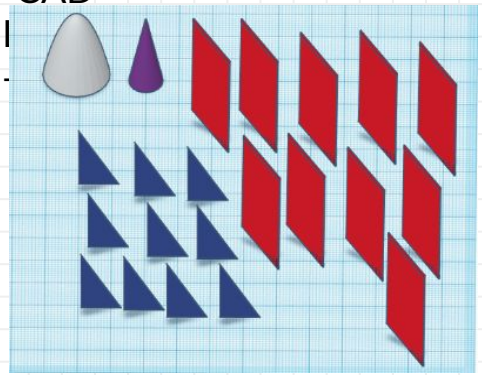
-CAD



Rocket Fins & Nose Tips:

- Red Fins: Parallelogram
- Blue Fins: Triangle
- White Rounded Off Nose Cone
- Purple Pointed Nose Cone

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Bill of Materials

(for all project items to be purchased, or provided even at no cost)

Project Name: Father of Rocketry

Date:

Project Team: Aiden Pritchett & Abel Garcia

Budget Limit:

Date Needed	Vendor / Store (could be You or Harty)	Item Number	Item Description (might want to detail is for specific "idea" for project)	Unit (each, 3-pack, etc)	Quantity	Cost per Unit	Subtotal
10/23/2019	*Walmart*	*552734083*	*Scotch Magic Tape Dispenser 4 Pack, 3/4in. x 300in. per Dispenser, C*	*4-pack*	*1*	*$5.88*	*$5.88*
10/23/2019	Walmart	998090	Georgia-Pacific Standard Paper 8.5" x 11", 20lb/92 Bright, 750 Sheet	ea	1	$5.47	$5.47
						Total=	$11.35

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- ***Team**: Aiden Pritchett & Abel Garcia*
- ***Customer/Context**: I'm building for Dr. Harty*
- ***Problem; Criteria & Constraints**: paper, tape, and paper clip.*
- ***Background Research**: Robert Hutchings Goddard influenced our designs*
- ***Concept Overview**: By sliding the paper rocket on the air compressed rocket launcher. The rocket that went further will win.*

- ***Resources Needed:***

(for all proj... items to be purchased, or provided even at no cost)

Project Name: Father of Rocketry — Date:

Project Team: Aiden Pritchett & Abel Garcia — Budget Limit:

Date Needed	Vendor / Store (could be You or Harty)	Item Number	Item Description (might want to detail is for specific "idea" for project)	Unit (each, 3-pack, etc)	Quantity	Cost per Unit	Subtotal
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10/23/2019	Walmart	998090	Georgia-Pacific Standard Paper 8.5" x 11", 20lb/92 Bright, 750 Sheet	ea	1	$5.47	$5.47
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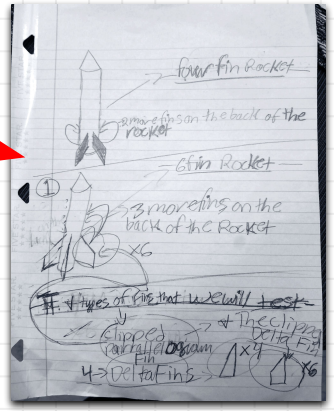
- ***Design Details:***



- ***Risks & Challenges: If rocket fails we will have a backup rocket to test out.***

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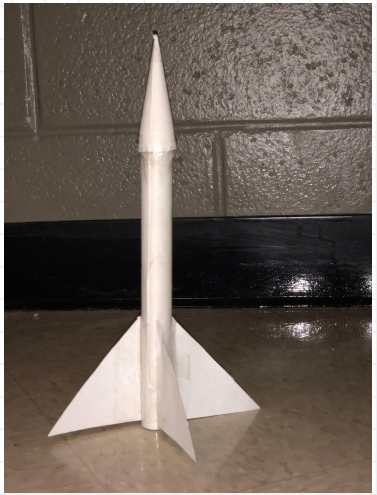

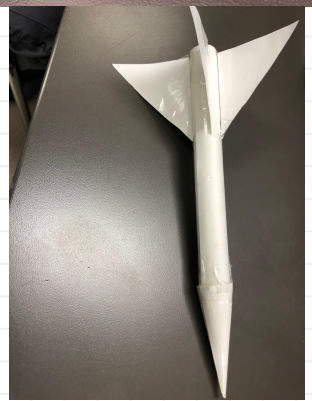

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Use these **EDP #'s** on your daily entry slides

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1A: How will I make my dragster race car go faster than everybody else.
1B: Dr. Harty will overview my project.
1C: Two (2) individuals per chapter, one (1) entry per individual.

- A dragster must have four (4) wheels, no more.
- Two (2) wheels must meet the requirements in #2 and #3 below.
- The other two (2) wheels must meet the requirements in #4 and #5 below.
- All four (4) wheels must touch the racing surface at the same time.
- All wheels must roll.
- Wheels must be made entirely from plastic.
- Dimensions must be consistent for the full circumference of each wheel.
- Measurement represents the FULL surface contact point where wheel makes contact with the track.

2.Front diameter 32mm 37mm
3. Front width (at surface contact point) 1.5mm 5mm
4. Rear diameter 35mm 40mm
5.Rear width (at full, unbroken, surface contact point) 12mm 18mm
1. The power plant hole must be at the farthest point at the rear of the car and must be drilled parallel to the racing surface to assure proper puncture of the CO2 cartridge. A minimum of 3mm thickness around the entire power plant hole must be maintained on the dragster for safety. The inside of the power plant hole must not be intentionally painted.
2.Hole depth 45mm 55mm
3. Safety zone thickness 3mm
4.Chamber diameter 19mm 20mm
5.Lowest point of chamber diameter to race surface (with wheels) 26mm 40mm
1. Dragsters must have two (2) screw eyes (no more) per car that meet tolerances. Screw eyes must not make contact with the racing surface. The track string must pass through both screw eyelets, which are located on the center line of the bottom of the car. Glue may be used to reinforce the screw eyes. It is the responsibility of the car designer/ engineer to see that the screw eye holes are tightly closed to prevent the track string from slipping out. As with all adjustments, this must be done prior to event check-in.
2. Inside diameter 3mm 5mm
3.Distance apart (at farthest points) 150mm 270mm

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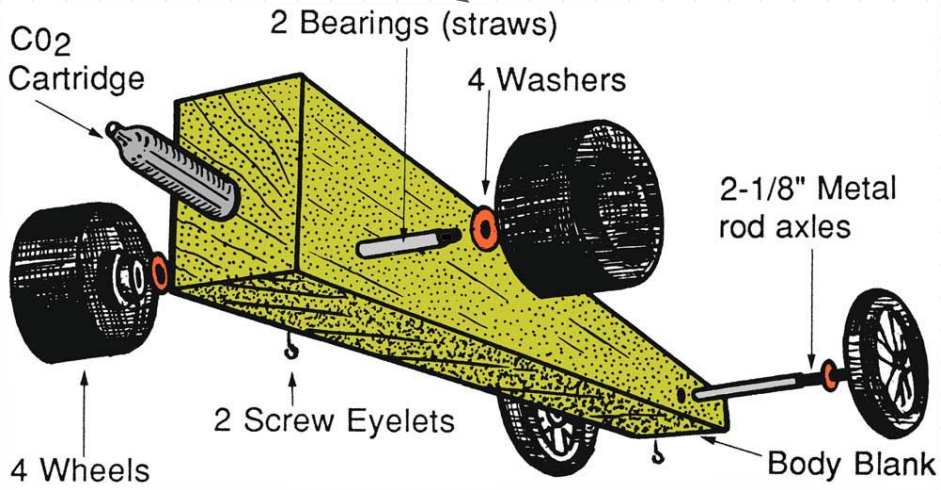
2A



2B

https://www.google.com/url?sa=i&source=images&cd=&cad=rja&uact=8&ved=2ahUKEwixuo3M0cDmAhUVd8KHUP6C84Qjhx6BAgBEAI&url=http%3A%2F%2Fmfranzen.ca%2Fpages%2Fcor%2Ftij1o1-fs_u4.html&psig=AOvVaw0xv5pfkiwZZ7FSlz75LdW7&ust=1576807967642267

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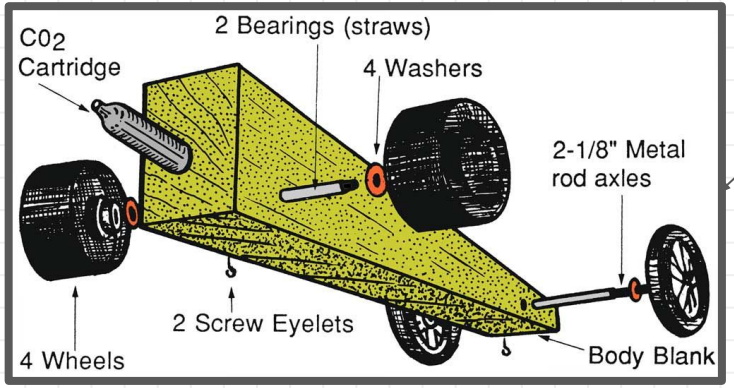
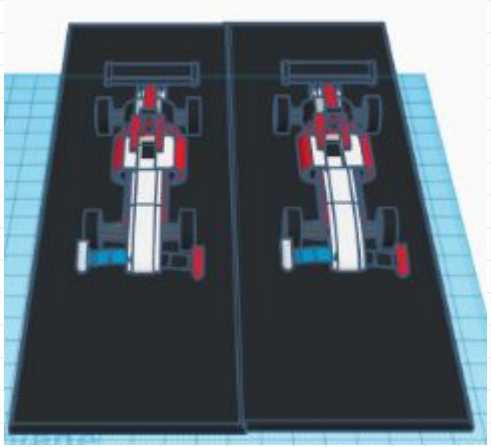


Sketches and details

3A



or

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https://drive.google.com/file/d/1AGrj66gRYYIng5FnOBTJCQK9iSP9nFFv/view

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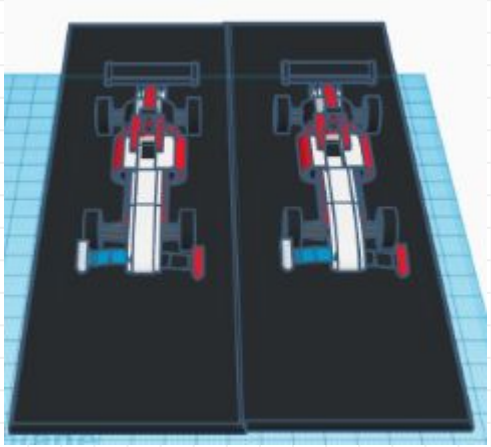

or

Bill of Materials (BOM)

(for all project items to be purchased, or provided even at no cost)

Project Nar	Dragster Bill of Materials					Date:	10/18/2019
Project Tea	Aiden Pritchett and Abel Garcia						
0		Item	Item Description	Unit (each, 3-pack, etc)		Cost	
Date	You or	Number	to detail is		Quantity	per Unit	Subtotal
12/19/2019	Harty	WDR-BB1	blank	3-pack	1	$3.45	3.45
12/19/2019	Harty	W53341	Axle	3-pack	1	0.07	0.07
12/19/2019	Harty	PS1	Straw	3-pack	1	0.01	0.01
12/19/2019	Harty	W21534	Wheel	3-pack	2	0.875	1.75
12/19/2019	Harty	W53341	Axle	3-pack	1	0.07	0.07
12/19/2019	Harty	PS1	Straw	3-pack	1	0.01	0.01
12/19/2019	Harty	W21534	Wheel	3-pack	2	0.875	1.75
						TOTAL CO	$7.11

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Notes - Annotated Photos/Videos - Data - Sketches *("INSERT" > TextBox, Image, Video, Line)*

1A: Problem

- My objective is to build a wind turbine fan that will generate the highest voltage.

1B:

- Voltage will be measured using a multimeter attached to the generator leads.
- Student will have three opportunities and the three voltages will be averaged.
- Award places determined by voltage ranking.
- Ties will be broken by testing efficiency of the wind turbine.

1C:

- I need to build 24 pvc pipe wind turbine blades so that I can make two 12 bladed modules.

Notes - Annotated Photos/Videos - Data - Sketches *("INSERT" > TextBox, Image, Video, Line)*

- Research Notes and Source Citations Together
- Stand Height: 24 in (must use stand with gear box system provided by GATSA)Maximum blade diameter: 36 in, and the Maximum number of blades: 12. https://www.youtube.com/watch?v=z9gmftRz5l4

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- Stand Height: 24 in (must use stand with gear box system provided by GATSA)Maximum blade diameter: 36 in, and the Maximum number of blades: 12.

Notes - Annotated Photos/Videos - Data - Sketches *("INSERT" > TextBox, Image, Video, Line)*

Design Criteria	Weight	Soln. A		Soln. C	
		Rating	Weight Scoring	Rating	Weight Scoring
Time	99%	3	2.97	4	11.88
Transport	100%	5	5	6	30
Ease of Use	30%	3	0.9	5	4.5
Lightweight	20%	3	0.6	5	3
Durable	100%	4	4	6	24
Cost	15%	2	0.3	3	0.9
Totals			13.77		74.28

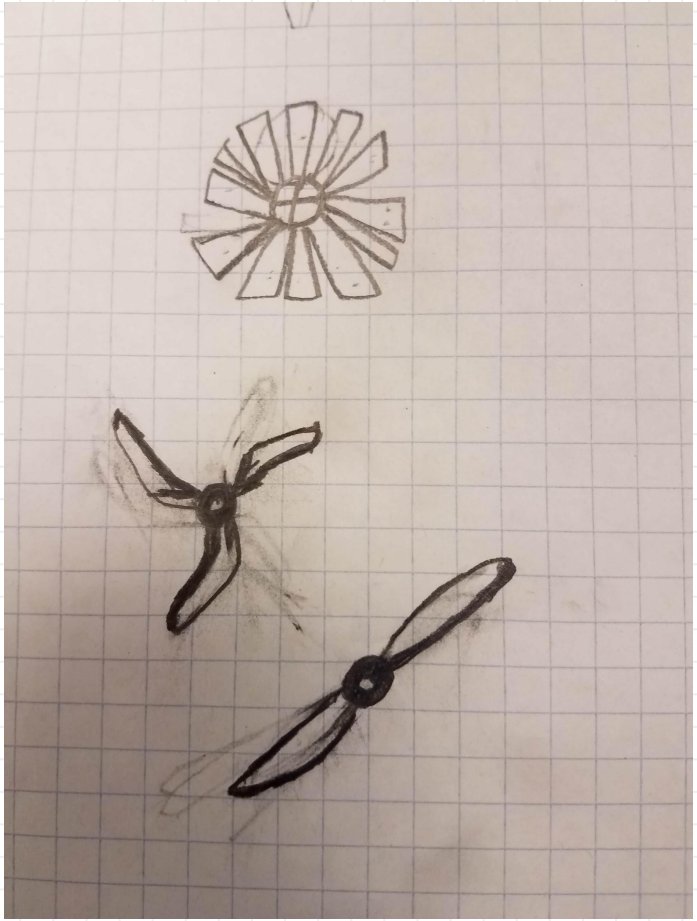
Notes - Annotated Photos/Videos - Data - Sketches *("INSERT" > TextBox, Image, Video, Line)*

Propellers

6in by 6in

4.25in by 4.25in

5.25in by 5.25in



Notes - Annotated Photos/Videos - Data - Sketches *("INSERT" > TextBox, Image, Video, Line)*

Bill of Materials (BOM)

(for all project items to be purchased, or provided even at no cost)

Project Name:	Wind Turbine					Date: 9/7/19	
Project Team:	Aiden Pritchett						
	Vendor / Store	Item	Item Description	Unit (each, 3-pack, etc)	Quantity	Cost	
9/16/19	Lowes	42279	Steelworks 24-1/4-in x 3-ft Aluminum Sheet Metal	each	24	$21.48	$515.52
					TOTAL COST =		$515.52

Notes - Annotated Photos/Videos - Data - Sketches *("INSERT" > TextBox, Image, Video, Line)*

1A: Problem

- My objective is to build a wind turbine fan that will generate the highest voltage.

1B:

- Voltage will be measured using a multimeter attached to the generator leads.
- Student will have three opportunities and the three voltages will be averaged.
- Award places determined by voltage ranking.
- Ties will be broken by testing efficiency of the wind turbine.

1C:

- I need to build 24 pvc pipe wind turbine blades so that I can make two 12 bladed modules.

2A and 2b:

- Research Notes and Source Citations Together:
- https://www.youtube.com/watch?v=z9gmftRz5I4

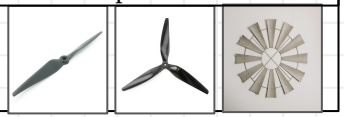
3A and 3B

- Stand Height: 24 in (must use stand with gear box system provided by GATSA)Maximum blade diameter: 36 in, and the Maximum number of blades:

4A: Design Matrix

Design Criteria	Weight	Soln. A		Soln. C	
		Rating	Weight Scoring	Rating	Weight Scoring
Time	99%	3	2.97	4	11.88
Transport	100%	5	5	6	30
Ease of Use	30%	3	0.9	5	4.5
Lightweight	20%	3	0.6	5	3
Durable	100%	4	4	6	24
Cost	15%	2	0.3	3	0.9
Totals			13.77		74.28

- 4B: CAD Layout (Propellers and Supplies)
- (3A and 3B): Propellers



4C: Bill of Materials

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- ALL MY PROTOTYPES FAILED

- But, I concluded that all my designs failed due to the design of my blades, but I know now that all these blades need a better design so that each blade can catch wind and rotate.