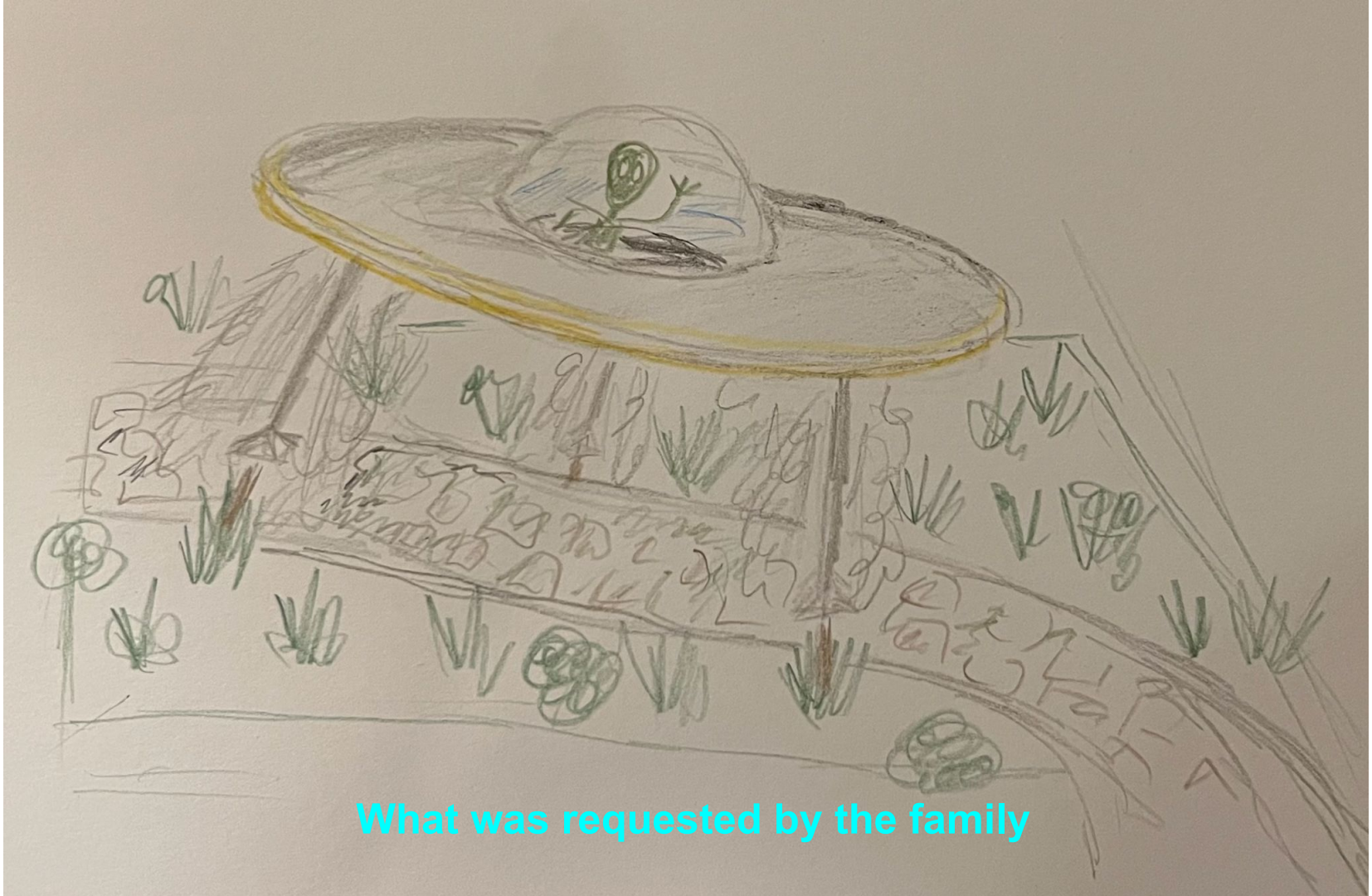
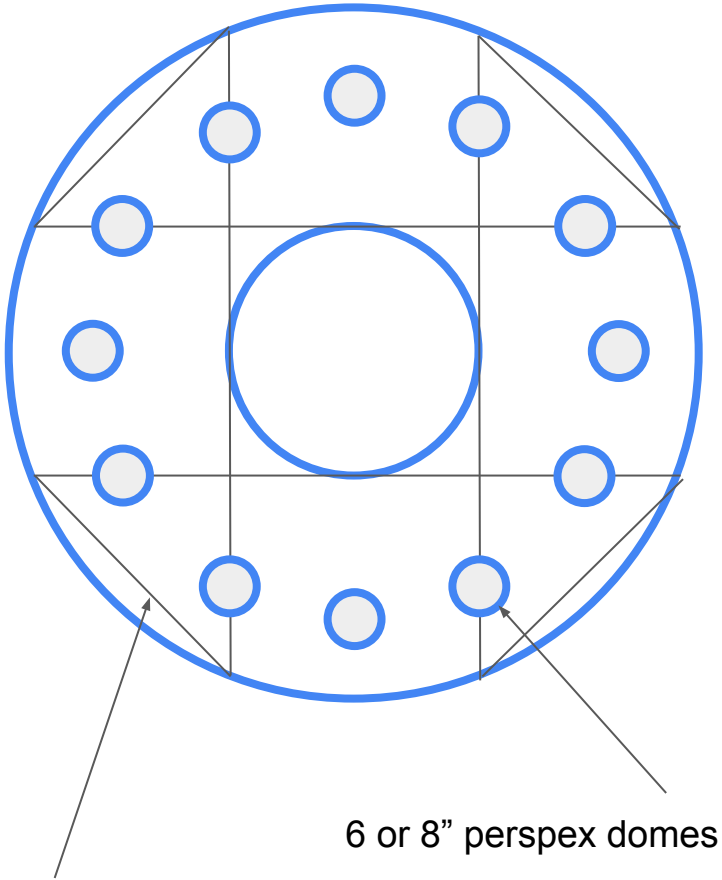
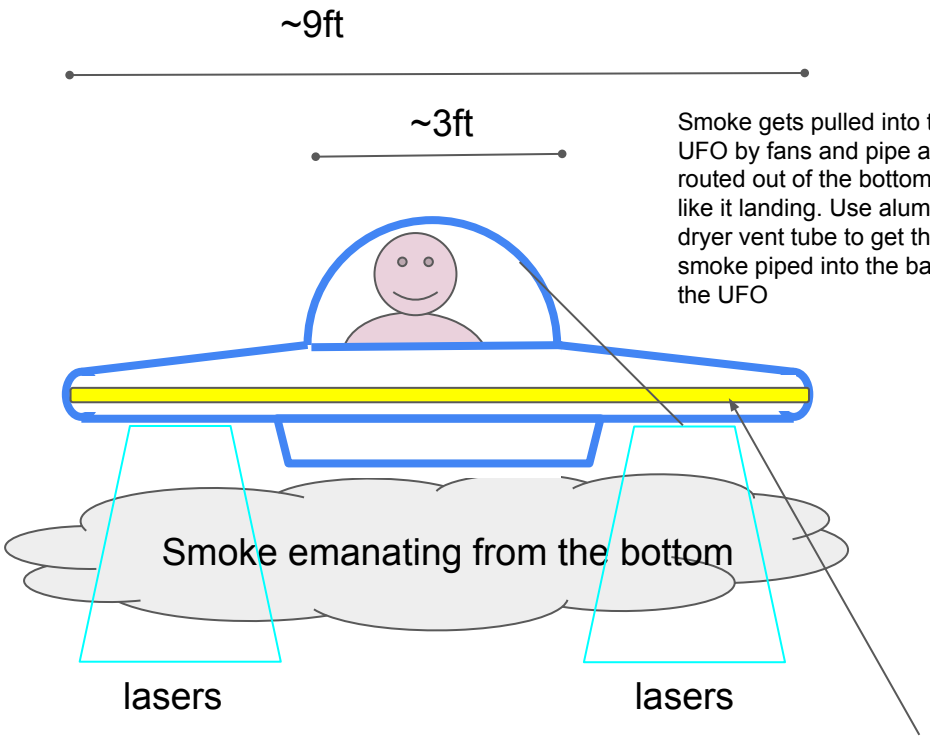
Project Brown Book

Notes on building a UFO for Halloween

If you are reading these notes then be aware they are scrappy / hacky. I built this UFO ground up and held most of it my head as I went along and then documented various parts afterwards. I really did hack this together moment by moment; which actually made it super-fun to do. As a result, these aren't really instructions to follow but could be a source of ideas and clues and help if you chose to make a similar UFO. You can always message me if you would like to find out more.


What was requested by the family

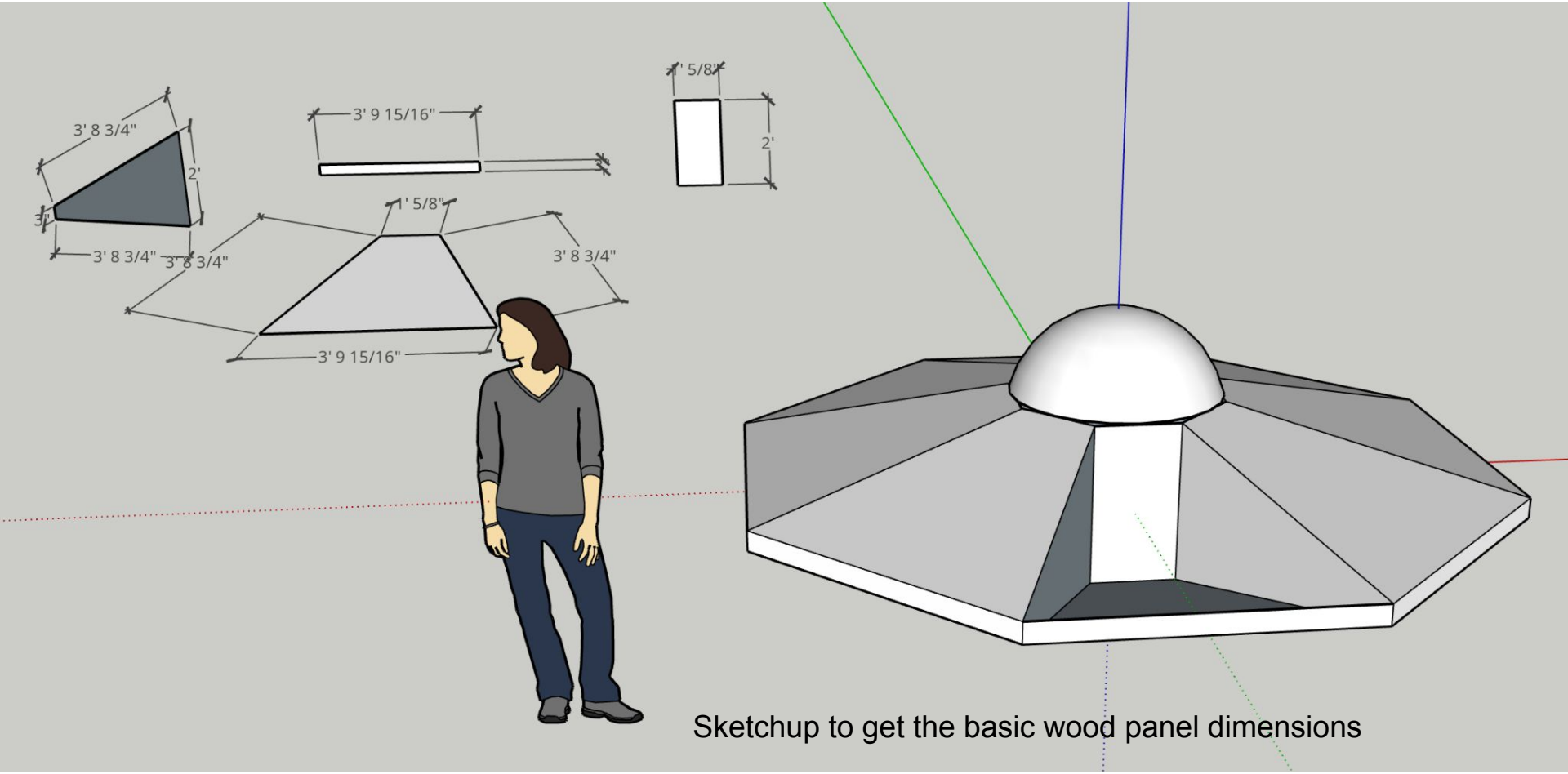




6 or 8” perspex domes that emits pulsating light

Frame ~= not to heavy but strong; nuts and bolts and can be dismantled and taken apart and stored. Octagonal, with PVC pipe bent in to make the circular edge. Thin ply panel, painted silver. Could do a final aluminium foil wrap at the end to finish it off. All wiring and electronics have to be waterproofed - expect rain on it.

Power supply for all the lights and computers will be beefy - guessing need to incorporate a ton of wiring and about 300watts of PSU.



Sketchup to get the basic wood panel dimensions

Various parts while noodling:

3 foot dome: here

6 inch domes:here

Lasers: here

Fog machine: here

CPUs

LED adaptor boards

3x reels of neo pixels

Power supplies

½ board 8x4’ = 3 so far (used for wings, octagon core panel, collars for the octagon core

3” x 8’ pine plank = 8 so far (used for ears, outer circumference)

3.5” deck screws; 1.5” wood screws; 1” wood screws, 2” deck screws;

Make the outer rings lower res?
use these… 16ft x 300LEDs - 18 per foot

LED compute & power needs

35OW 5v PSU

WS2811 LED reference
https://www.pjrc.com/teensy/td_libs_OctoWS2811.html#tech

1000 LEDs can be updated in 3.8 ms, which allows a theoretical update rate of 240 Hz.

Worse case ~= 1.1KW lighting power; 265W nominal; 16W standby

What?	Diameter (ft)	Circumference	How many	Total length	# LEDs	Max I	*Likely I*	Max W	Likely W
outer rings	9	28.3	2	56.5	2545	153	*38*	763	191
main dome	3	9.4	1	9.4	424	25	*6*	127	32
mini domes	0.5	1.6	8	12.6	565	34	*8*	170	42
				78.5	**3534**	**212**	***53***	**1060**	**265**
LEDs per ft	45								
power per LED mA	60	<< maxed out to full white							
idle mA	0.9					3.2		16	<<idle power

Rough plan

Buy the big dome & build a frame around it

Buy LED strips, and start to power them and test resolution and software speed for the various rings

Get a smoke machine and PC fans to start to test the ducting and smoke draw that’s possible

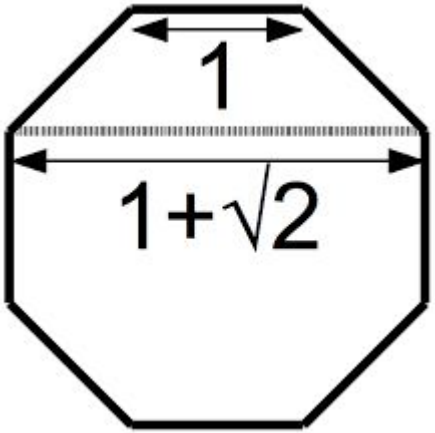
…?

…?

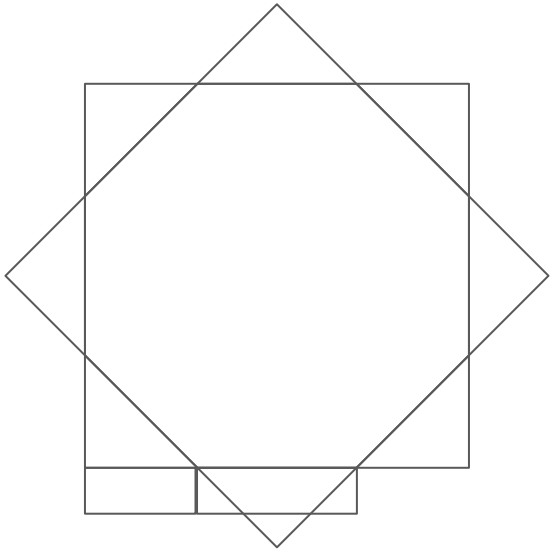
…?

Have awesome UFO party

Octagon Framing



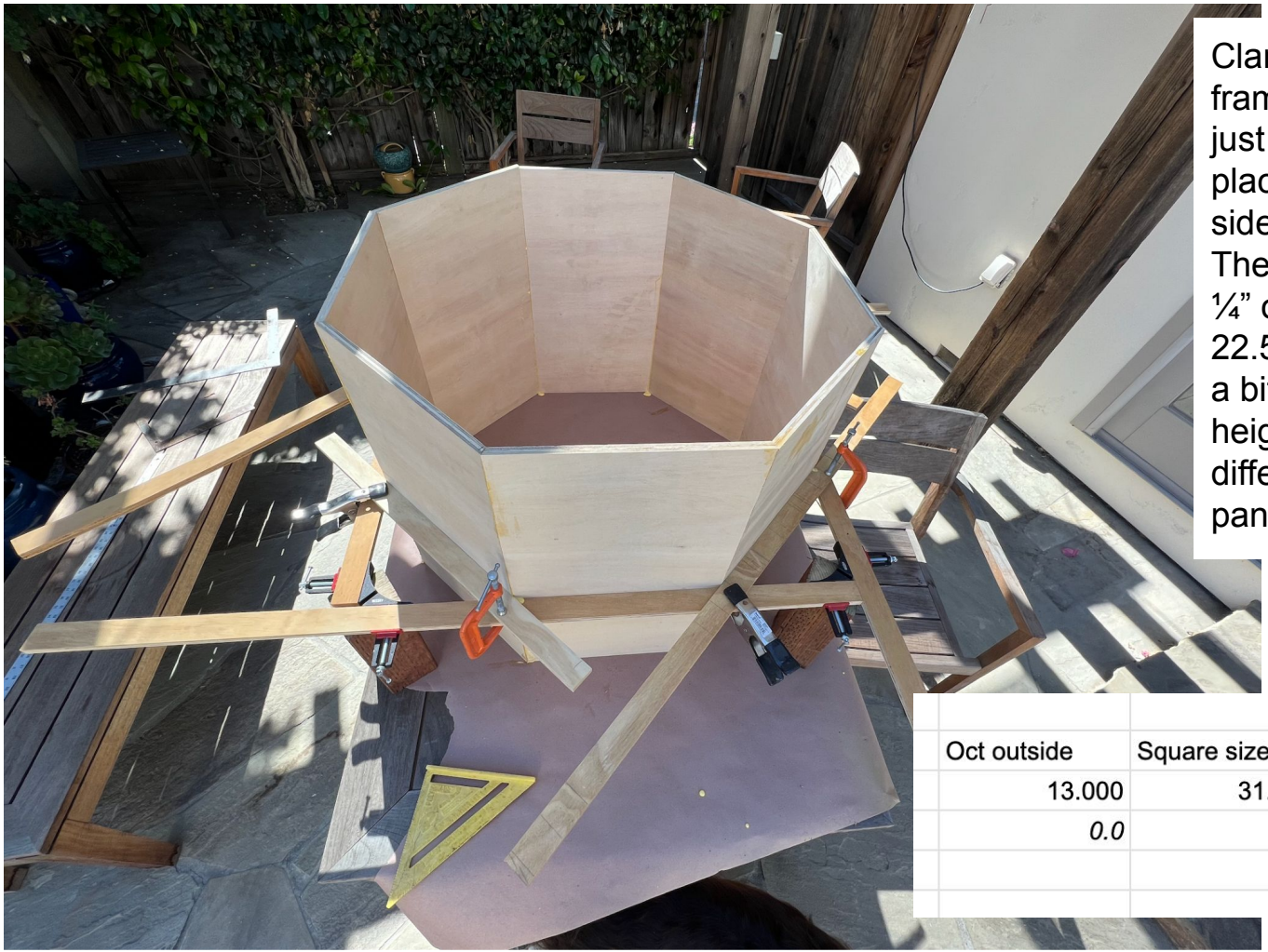
Oct outside	Square size	
13.000	31.385	inches
0.0	*6.2*	*sixteenths*
	3.1	eighths



Starting with 8 panels with edges at 22.5deg.

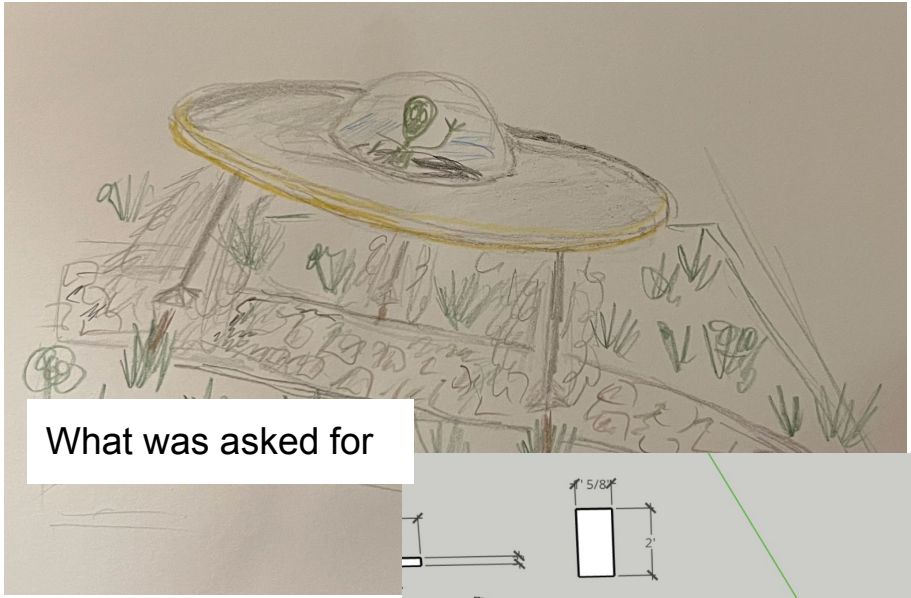
Box in with 2 squares to get the octagon glued and set regular.

The use the squares to cut down to 2 octagon collars to strengthen the octagon panels.



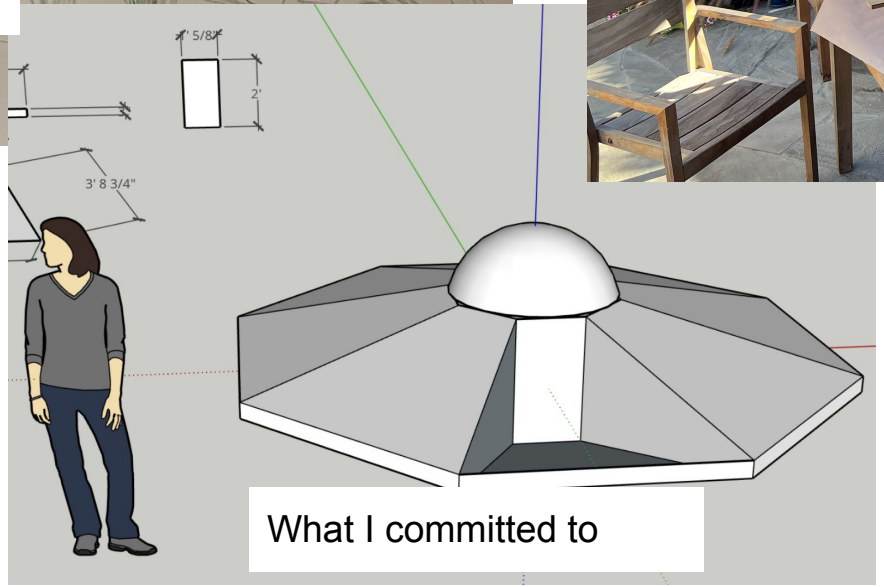
Clamped octagonal frame half way up - just enough hold in place while the 8 sides align and glue. The math was out by ¼” or more and the 22.5deg cuts were off a bit leading to some height and alignment difference on the panels

Oct outside	Square size	
13.000	31.385	inches
0.0	*6.2*	*sixteenths*
	3.1	eighths

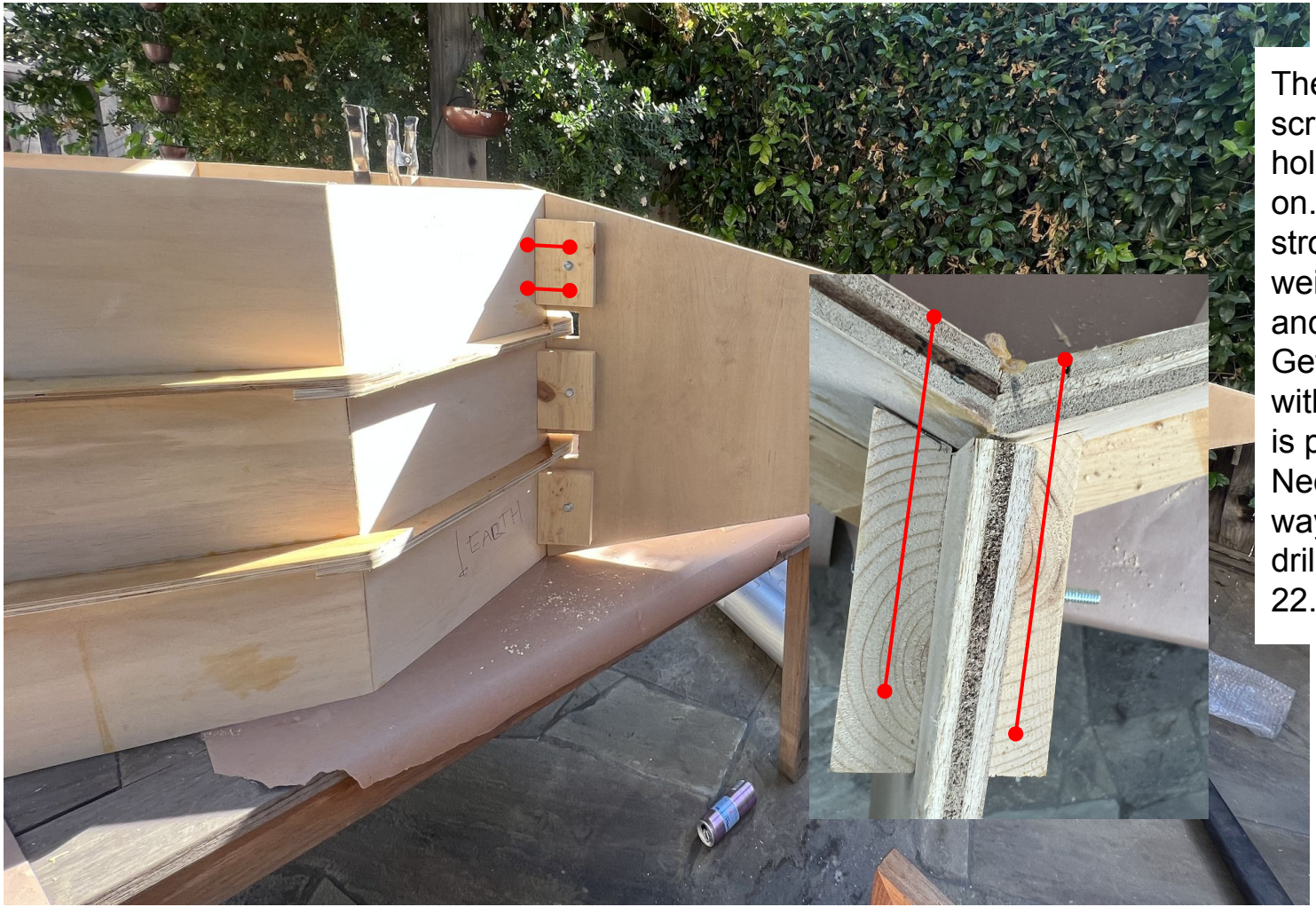


What was asked for

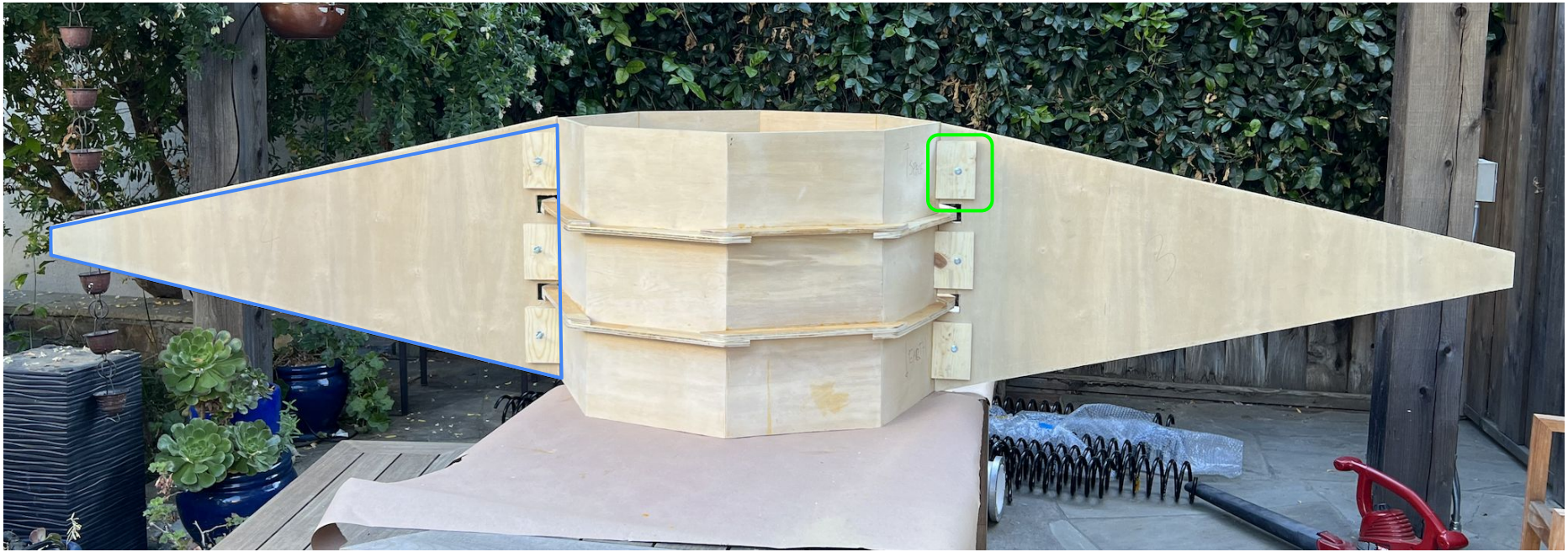
Progress so far



What I committed to

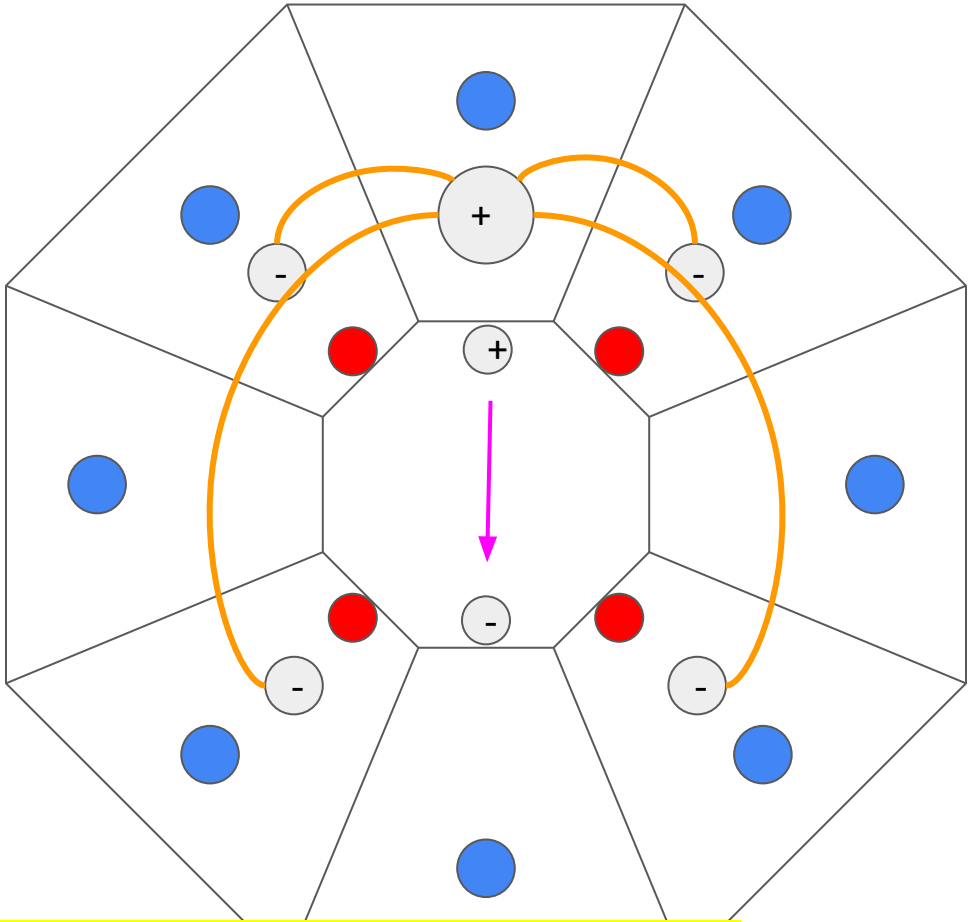


There are 3.5” deck screws and glue holding these pieces on. They need to be strong to hold the weight of the panels and outer frame. Getting these in place with the long screws is proving really hard. Need a new / better way. Or learn how to drill straight at 22.5deg!



The outer collars were pretty easy to template cut and aligned pretty well. The ‘wings’ are held in place with 3 bolts and embedded/spiked nuts. I didn’t template this and so each wing will only align with one particular vertex on the octagon. Will have to label them. The ‘ears’ are templated at 5” with one 22.5deg edge. Need 8x6=56 of them and 112 3.5” deck screws. Attaching the ears is a real pain to do. The bolts and ears are used so it can be disassembled.

What next?



flanges for 2” steel legs

Top side 8” domes with lights in

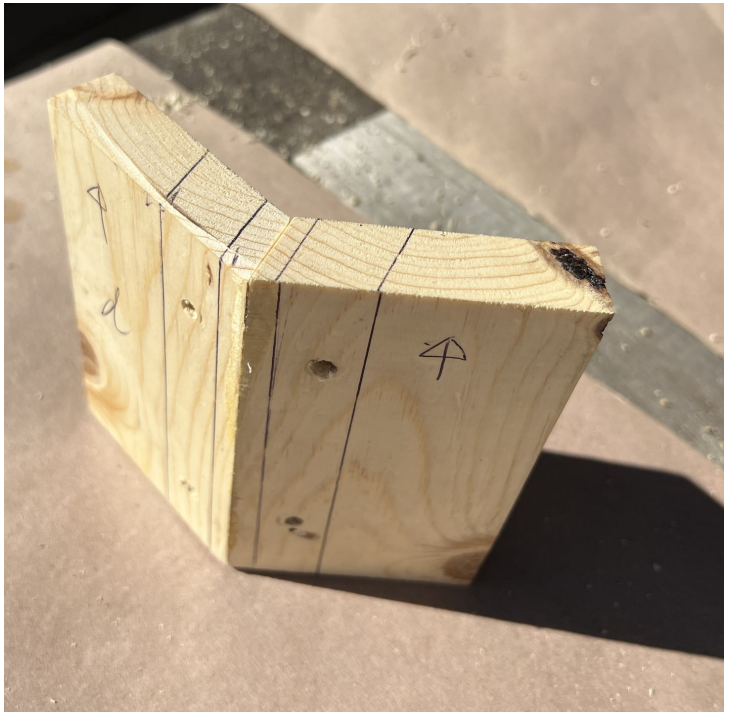
Pull smoke through the dome

+

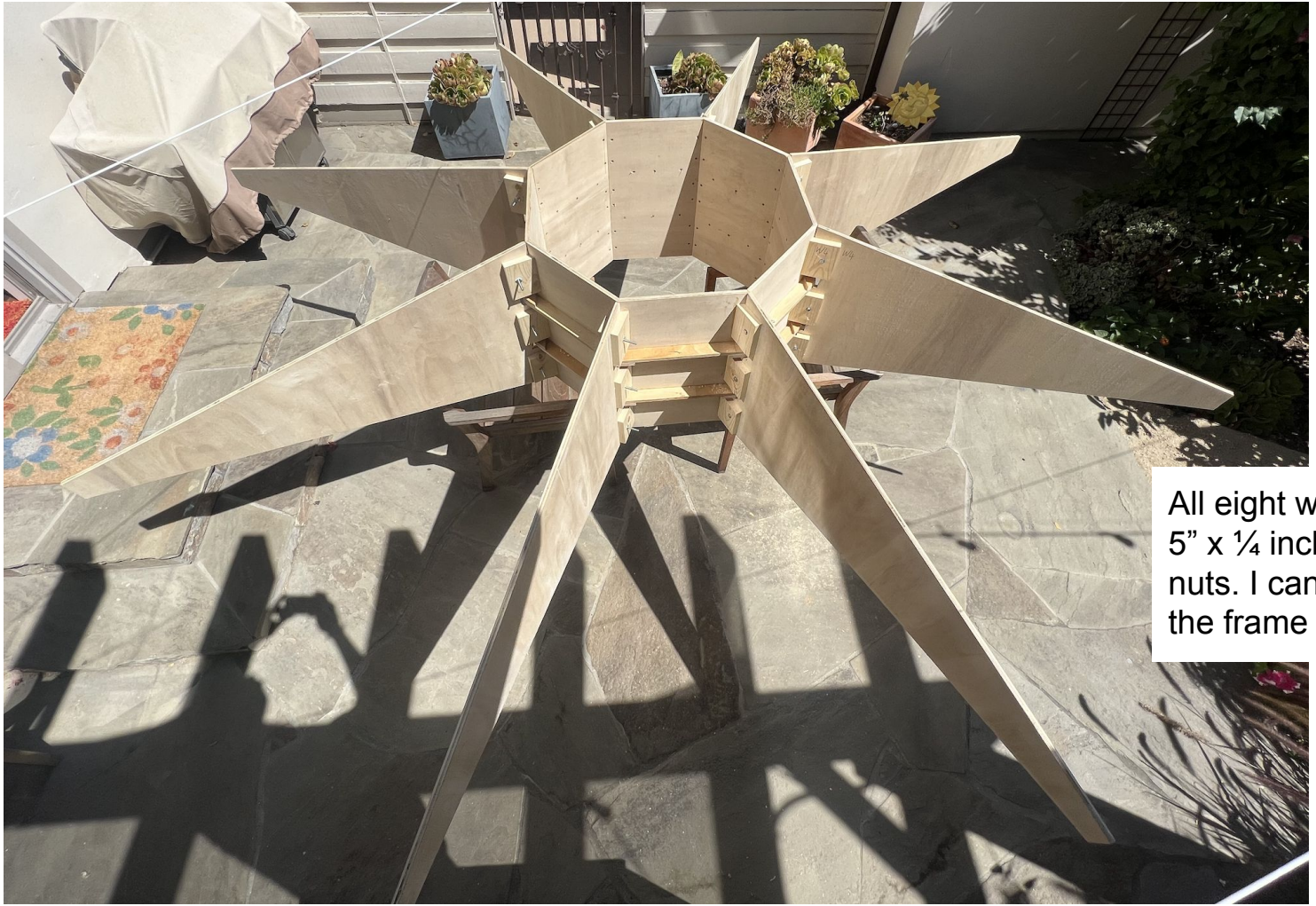
Smoke flow:
+ ingress
- egress
500CFM in and out

4” ducting

Not going to do the top side mini domes - too much!



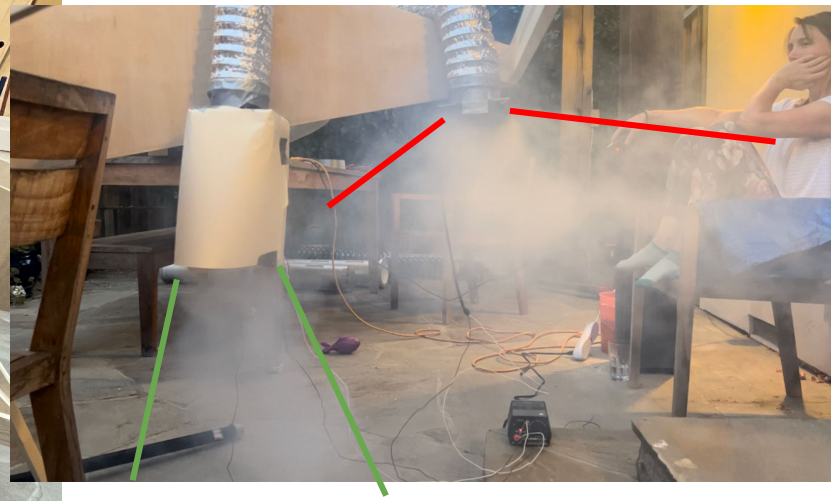
Making jig and a drilling template helped a lot to get the ears in place. Also just taking time and drilling straight :) helped a bunch. Still, none of these came out in the right place but on average they are good enough.



All eight wings bolted on with 5” x ¼ inch bolts and grip nuts. I can lift this much of the frame by myself

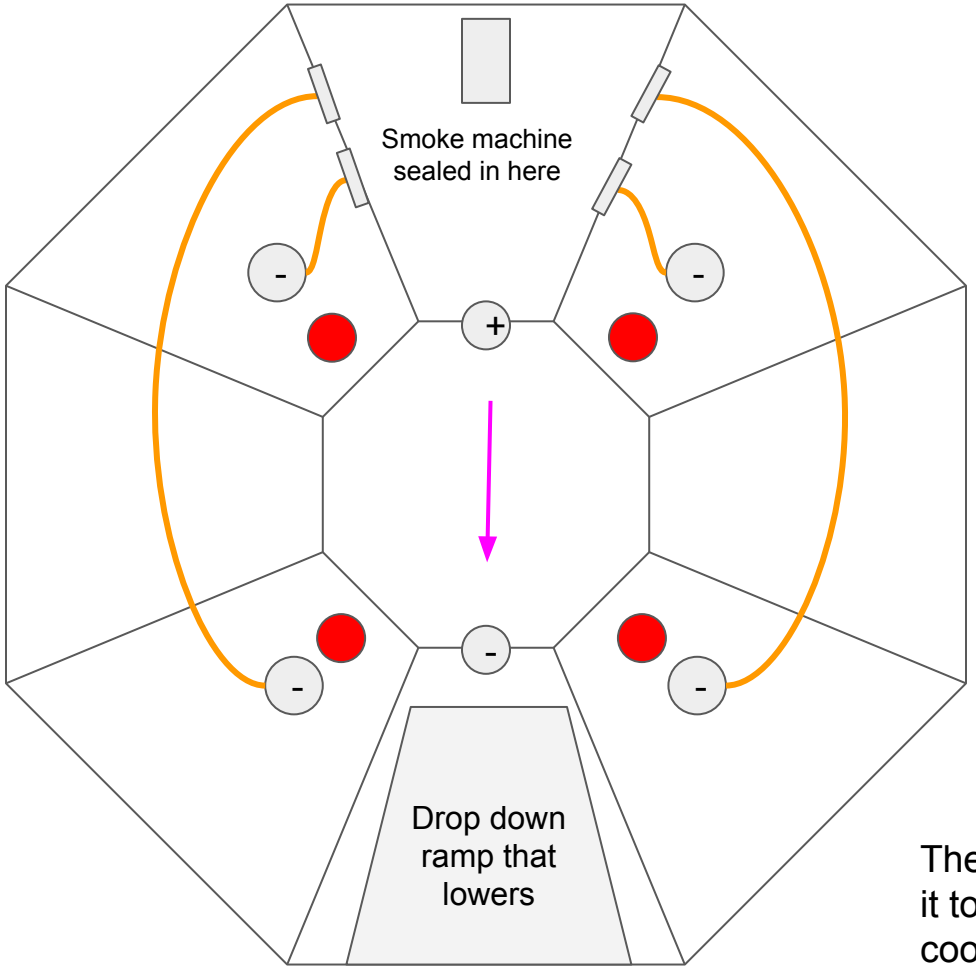
The outer edges are 3” x ½” common board with 22.5 deg’ ears glued and screwed to the edge boards. This means they can bolt through the wings to help make it dismantlable. Surprising after all of the work so far when all 8 edges were put on there was only a ¼ inch error on the last edge board across the 11foot diameter :)

The basic frame done and all bolted together.



The fog machine makes about 2000 CFM of fog. The 2 fans and about 5 or 6 feet of 4” dryer duct easily move ~100 CFM each. We have more than enough fog making ability. If the fog comes straight out of the fan it disperses to quicky. If we add ~8” of extra tube after the fan it gets a lot more direction to make it look more like an exhaust/jet.

What next?



flanges for 1” steel legs

Pull smoke through the dome

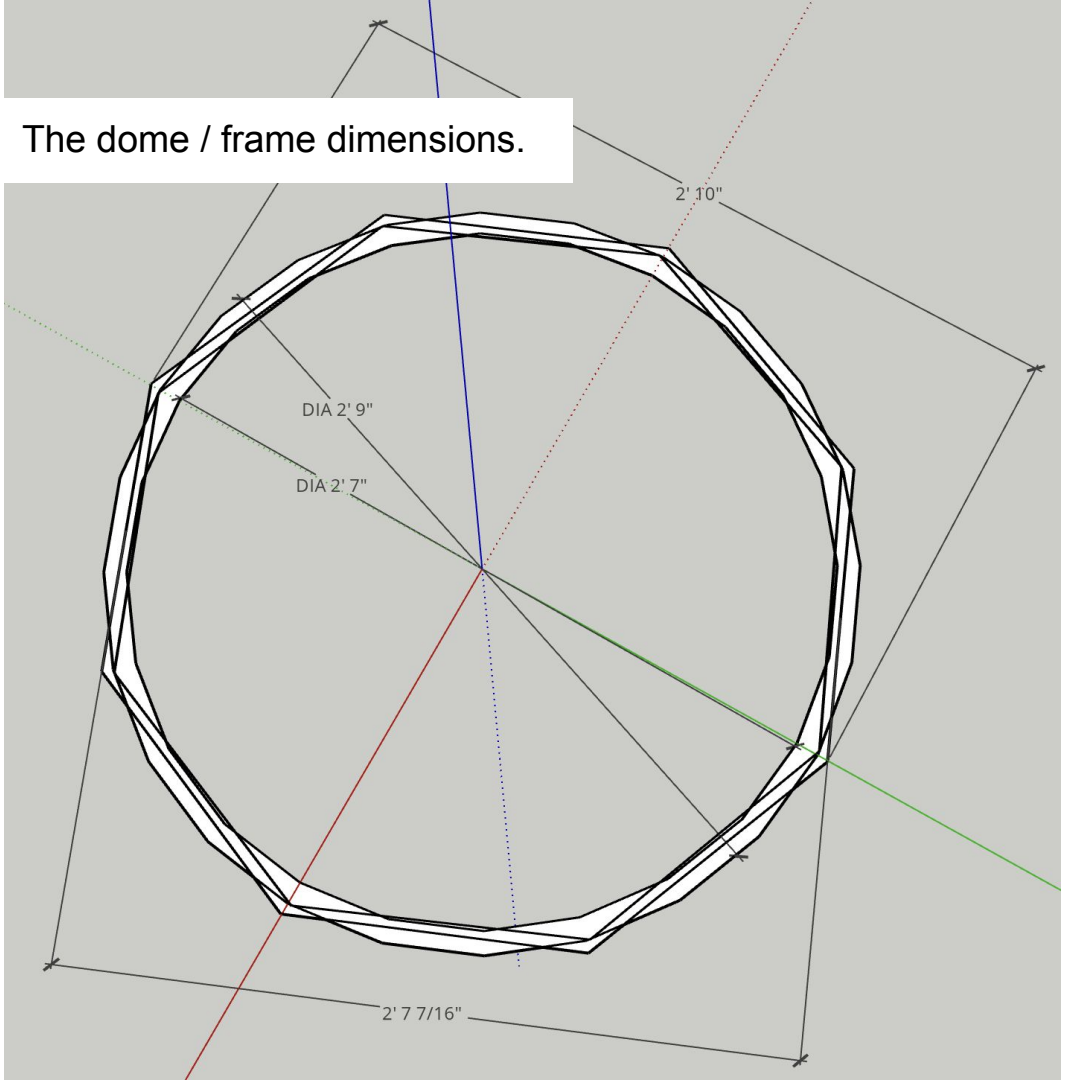
+

Smoke flow:
+ ingress
- egress
500CFM in and out

4” ducting

The fog needs spaces to expand. If it touches a surface before its cooled some of it turns to liquid.

The dome / frame dimensions.



Invoice removed, but I got the dome from the Plastic Guy in Sacramento. They did a great job…

Change the dome diameter to 31” with a 1” flange and outer diameter of 33”

What next?

All done

Fans & Fog:

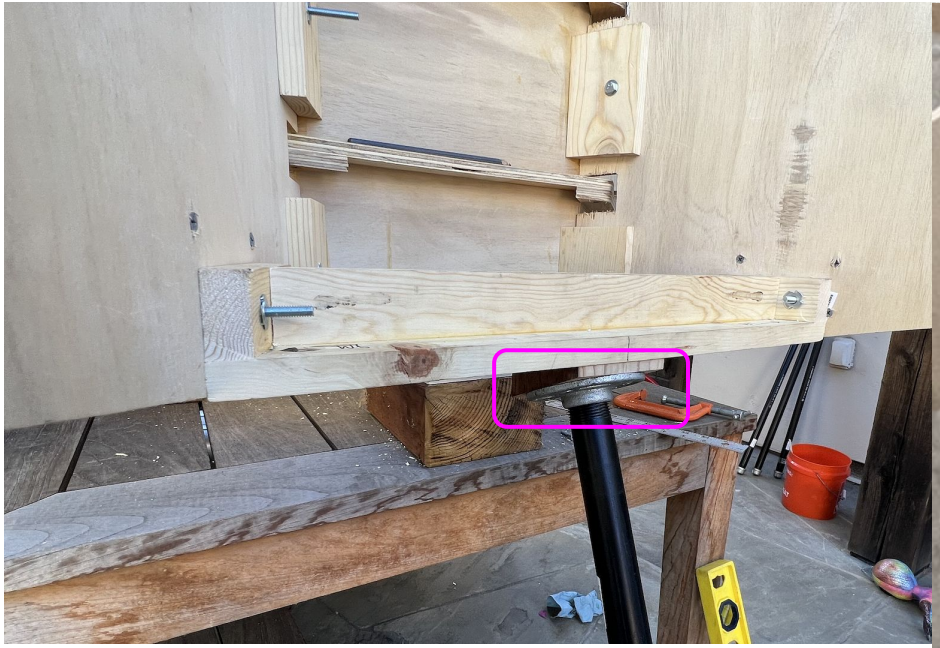
- ~~Order a relay board to turn on/off 6 fans. I2c controlled, 5V, relays rated at >12V.~~
- ~~Need a 12V PSU.~~
- ~~Order more fans and ducting~~
- ~~Need 4 core wire for the fans~~
- ~~Work out how to control the fog machine by SW~~

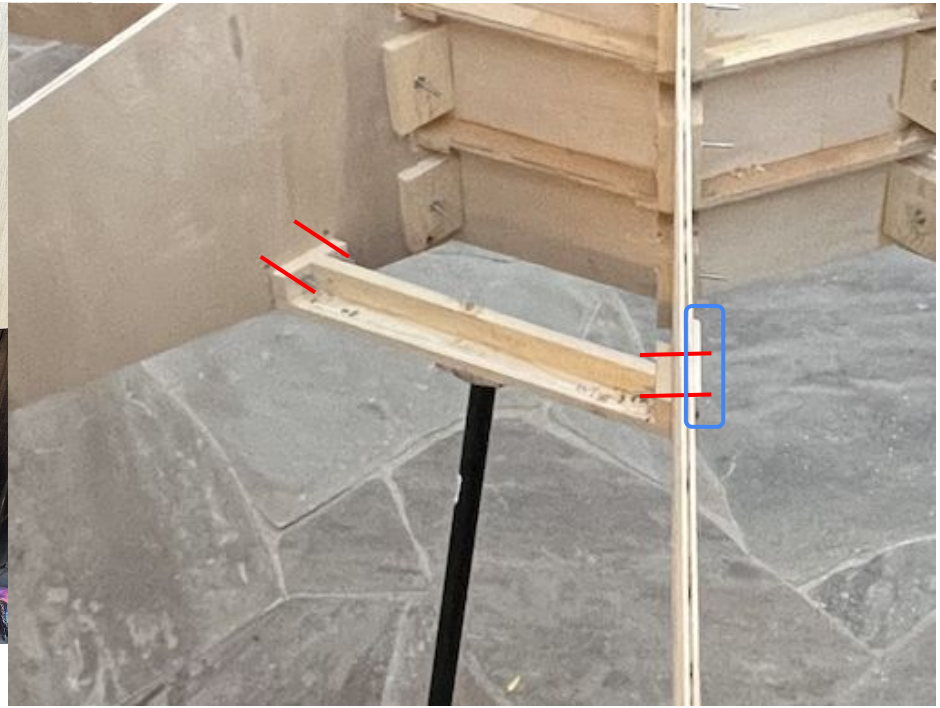
Lights:

- ~~Order 3 more neo pixel 16ft strips.~~
- ~~Work out the total length of the neopixels strips~~
- ~~Re do the power numbers~~

Other:

- Is there a generic switch/dial control board I get? Would be good to have simple push button control of things.





Leg attachments went a bit askew. I cut the leg holders to match the underside surface but instead cut them at 22.5deg which mean they mount flat/level. So I had to attach these to get the leg angle we wanted. The mounts are bolted through the wings and bolstered by glued/screwed wood the other side for mounting strength.

After a whole day of effort just to get the legs on they are now done and the whole structure is pretty strong and stable

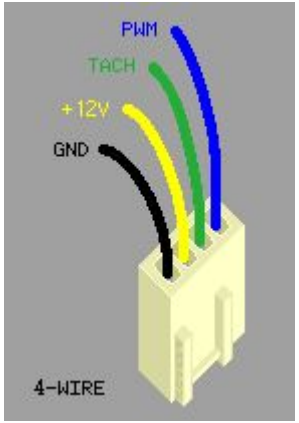
LED Power Numbers here: …

	These LEDS:					
	https://www.amazon.com/gp/product/B07P7WWRVH/ref=ewc_pr_img_1?smid=A1ON111AEWFN60&th=1					
	Feet	**Total Led**	**Per foot**	**Amps per foot**		
	16.4	300	18.29	1.1		
	Feet	**#LEDs**	**Power in A**	**Power in W**	**#channels**	
Outer circ'	34.6	632	37.9	189.6	2.11	<< 2 edges per
4 x 6" jets circ'	7.9	144	8.6	43.1	0.48	
Dome circ'	8.4	153	9.2	46.0	0.51	
8x50" Seg edges	34.7	634	38.0	190.2	2.11	
Pixel panels		*512*	*30.7*	*153.6*	1.71	
Total		2075	124.5	622.6	<< to hot for one PSU	
				2.08	<< to hot	
per 8 channels	300					
	This power supply:					
	https://www.amazon.com/dp/B06XK3X3PW?ref=ppx_yo2ov_dt_b_product_details&th=1					
	300					
Watts						
		#LEDs	**Power in A**	**Power in W**	**#channels**	
Pixel panels		512	30.7	153.6	8.00	
per 8 channels	64					

Fans are roughly 1.5W each, so need a 10.5W 12V PSU for all of those.

The fogmachine is 400W.

So all LEDs and panels and fog could add up to 11 (fans) + 400(fog) + 300(LED strips) + 160(LED panels) …. Getting towards 1KW.



Fan connector

```
// Relay Board:
// Power on state : LED Off & COM-->NC
// send a 0 : LED On & COM-->NO
// send a 1 : LED Off & COM-->NC
// 0x27 is the address when the dip switches are set to zero ; on label is inverted
```

- Fans consume ~0.25A each at 12v. ~0.28A when 1st on.
- They take about 6 seconds to stop spinning after power is removed.
- Need 4ft of wire per fan to reach the relay board

Fog machine

The fog remote control simply closes 120v via a relay and when the fog machine is ready it turns on 120v to the remote

Fog machine remote control wire - 120c →

USB adapter

5v

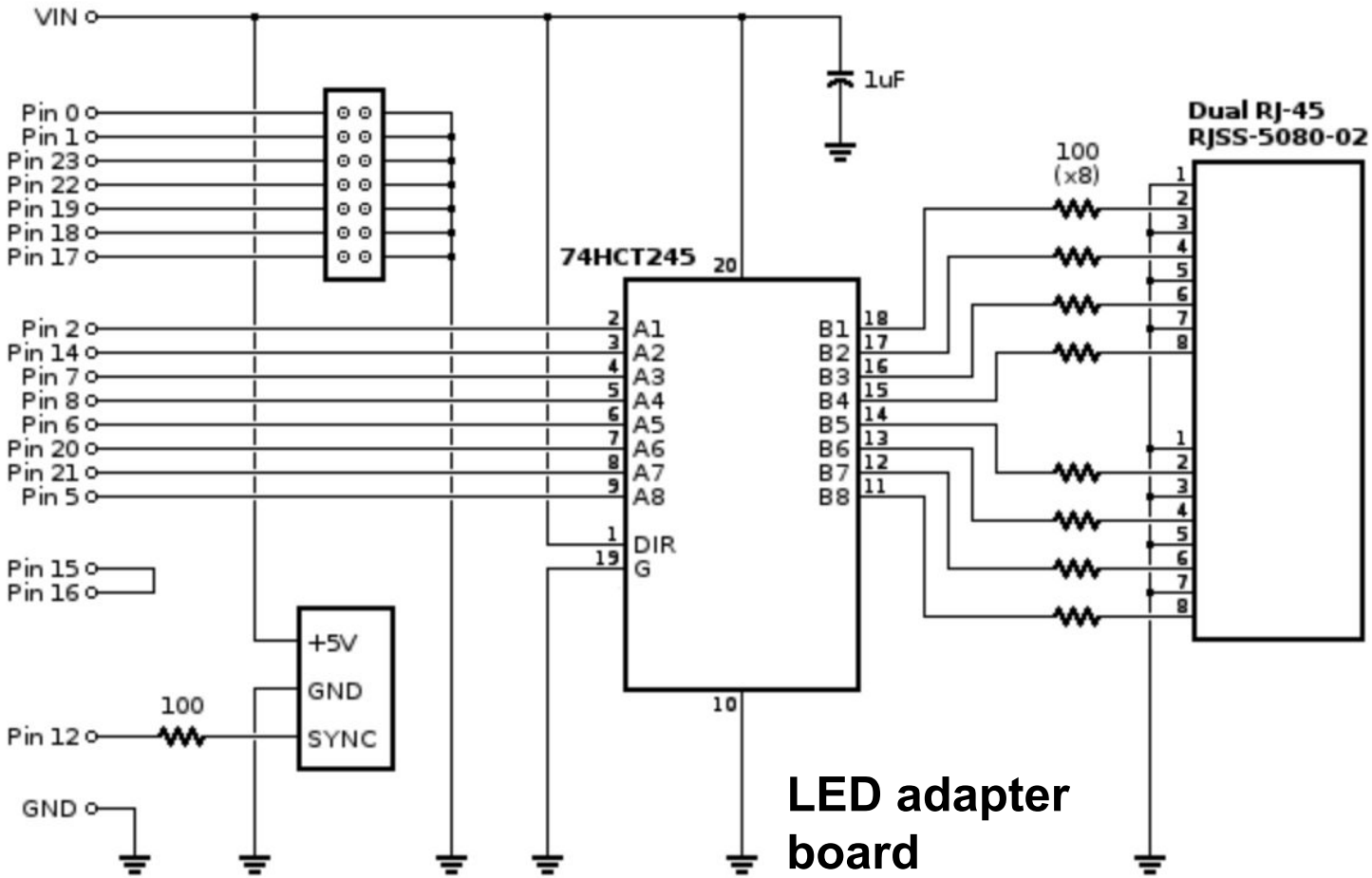
1.7k

3.3v →

3.3k

0v

Read this on one of the CPUs ADC pin 23 and close 120v on one of the relays


VIN
1uF
Pin 0
Pin 1
Pin 23
Pin 22
Pin 19
Pin 18
Pin 17
74HCT245
20
Pin 2
Pin 14
Pin 7
Pin 8
Pin 6
Pin 20
Pin 21
Pin 5
A1
A2
A3
A4
A5
A6
A7
A8
DIR
G
10
B1
B2
B3
B4
B5
B6
B7
B8
100
(x8)
Dual RJ-45
RJSS-5080-02
Pin 15
Pin 16
+5V
GND
SYNC
100
Pin 12
GND
LED adapter
board

Top RJ-45 Jack			Bottom RJ-45 Jack	
Wire	**Signal**		**Wire**	**Signal**
Orange	LED Strip #1 Data		Orange	LED Strip #5 Data
White/Orange	LED Strip #1 Ground		White/Orange	LED Strip #5 Ground
Blue	LED Strip #2 Data		Blue	LED Strip #6 Data
White/Blue	LED Strip #2 Ground		White/Blue	LED Strip #6 Ground
Green	LED Strip #3 Data		Green	LED Strip #7 Data
White/Green	LED Strip #3 Ground		White/Green	LED Strip #7 Ground
Brown	LED Strip #4 Data		Brown	LED Strip #8 Data
White/Brown	LED Strip #4 Ground		White/Brown	LED Strip #8 Ground

Signals with CAT6 T568A Termination:

Top RJ-45 Jack			Bottom RJ-45 Jack	
Wire	**Signal**		**Wire**	**Signal**
Green	LED Strip #1 Data		Green	LED Strip #5 Data
White/Green	LED Strip #1 Ground		White/Green	LED Strip #5 Ground
Blue	LED Strip #2 Data		Blue	LED Strip #6 Data
White/Blue	LED Strip #2 Ground		White/Blue	LED Strip #6 Ground
Orange	LED Strip #3 Data		Orange	LED Strip #7 Data
White/Orange	LED Strip #3 Ground		White/Orange	LED Strip #7 Ground
Brown	LED Strip #4 Data		Brown	LED Strip #8 Data
White/Brown	LED Strip #4 Ground		White/Brown	LED Strip #8 Ground

LED strip breakout

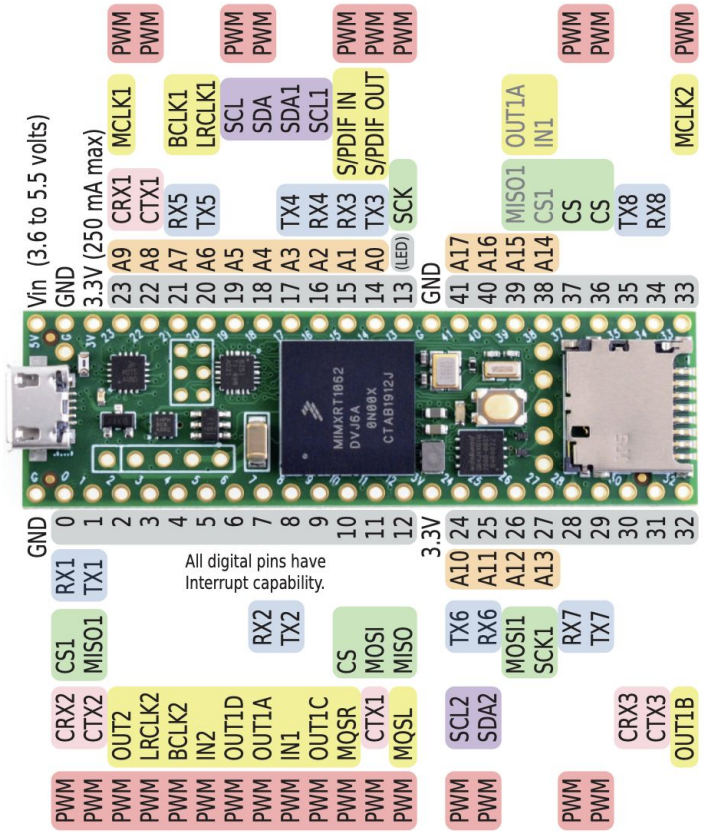
I am wired using this rj45 configuration

Welcome to Teensy® 4.1

32 Bit Arduino-Compatible Microcontroller

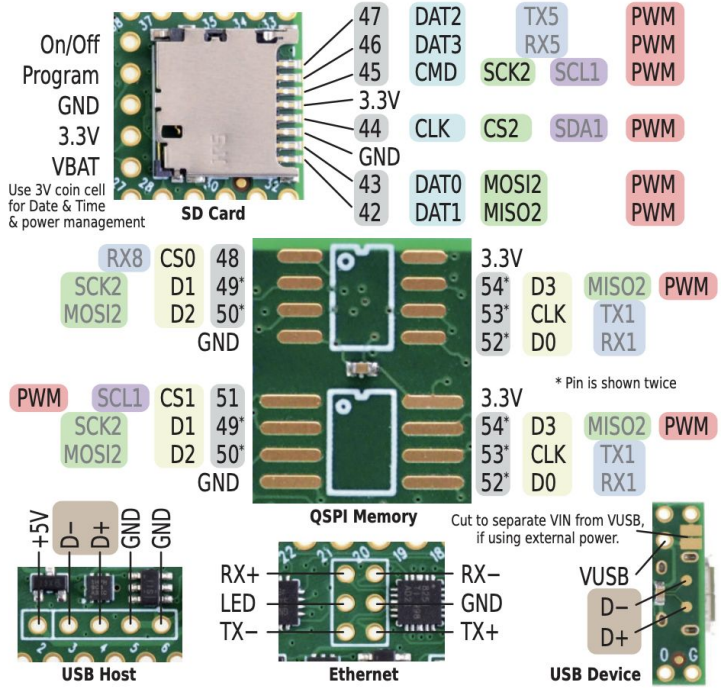
To begin using Teensy, please visit the website & click Getting Started.

www.pjrc.com/teensy



Teensy® 4.1 Features

Special Features and Additional Pins



For solutions to the most common issues and technical support, please visit:

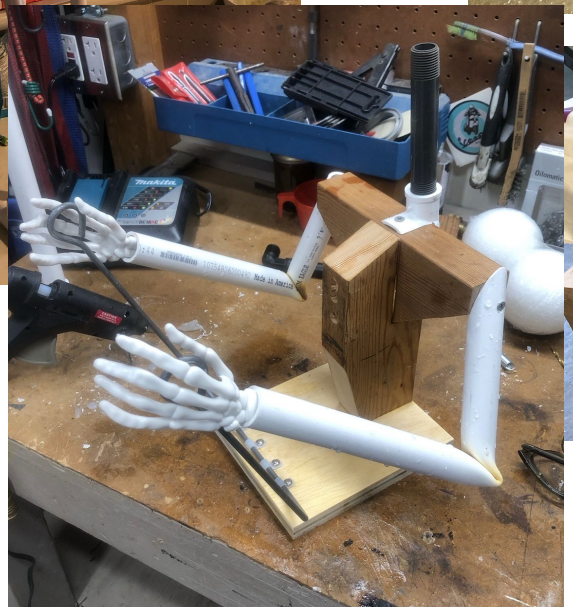
www.pjrc.com/help

Teensy 4.1 pins are **not 5 volt tolerant**. Do not apply more than 3.3V to any pin, except VIN & VUSB.

Teensy 4.1 System Requirements:
PC computer with Windows 7, 8, 10, 11 or later
or Ubuntu Linux 14.04 or later
or Macintosh MacOS 10.10 or later
USB Micro-B Cable

7 14833 87947 3

CPU Pins



Alien skeletons

What's next? - a random list until it's reasonably full/busy for the next 2 days:

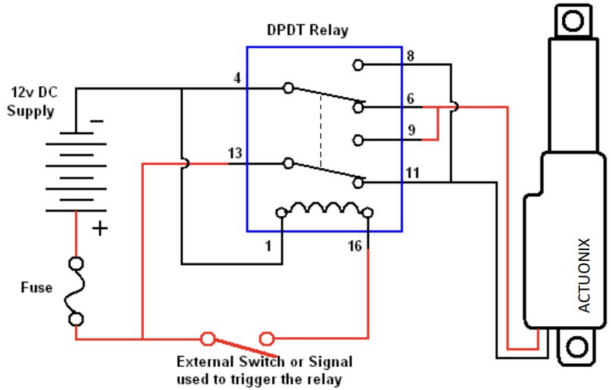
- ~~Build the front ramp and flap with a hinge ready to size up a linear actuator to open it~~
- ~~Make the UFO fan / ducts ready for mounting~~
- Size up the pilot and make the platform for it
- ~~Make the platform for the electronics~~
- ~~Figure out how to fill the smoke machine~~
- ~~Check in on the dome production - need a pick up date~~
- ~~Find a way to turn on/off the laser via SW~~
    - make a 3v supply for the laser so I dont need batteries
- ~~Fit the linear actuators~~
- .
- How will we lift this to the front yard? Make a trolley and strengthen some attachment points?
- How can I quickly fix it if breaks on halloween night - make it serviceable and have spares - what?
- .
- .
- A lot of stuff to do in code also tracked as comments there

ECO-WORTHY LINEAR ACTUATOR

Parameters

Applicable scenarios change accordingly By Models

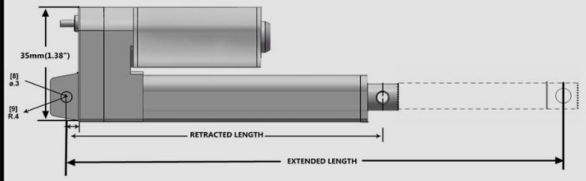
Actuation Force	20N (4.5lbs)	1000N (225lbs)	1500N (330lbs)	6000N (1350lbs)
Input Voltage	DC 12V	DC 12V	DC 12V	DC 12V
Speed(No Load)	0.6in / sec (15mm / sec)	0.55in / sec (14mm / sec)	0.23in / sec (5.7mm / sec)	0.19in / sec (5.mm / sec)
Protectional Class	IP54	IP54	IP54	IP54
Limit Switches	Not adjustable	Not adjustable	Not adjustable	Not adjustable
Warranty	Standard 1 year	Standard 1 year	Standard 1 year	Standard 1 year
Recommend For	DIY Toys	Windows	Chicken Coop Door /TV Sofa	RV Bed



1000NB SERIES

NEW Linear Actuator

IP54 12V 1000N

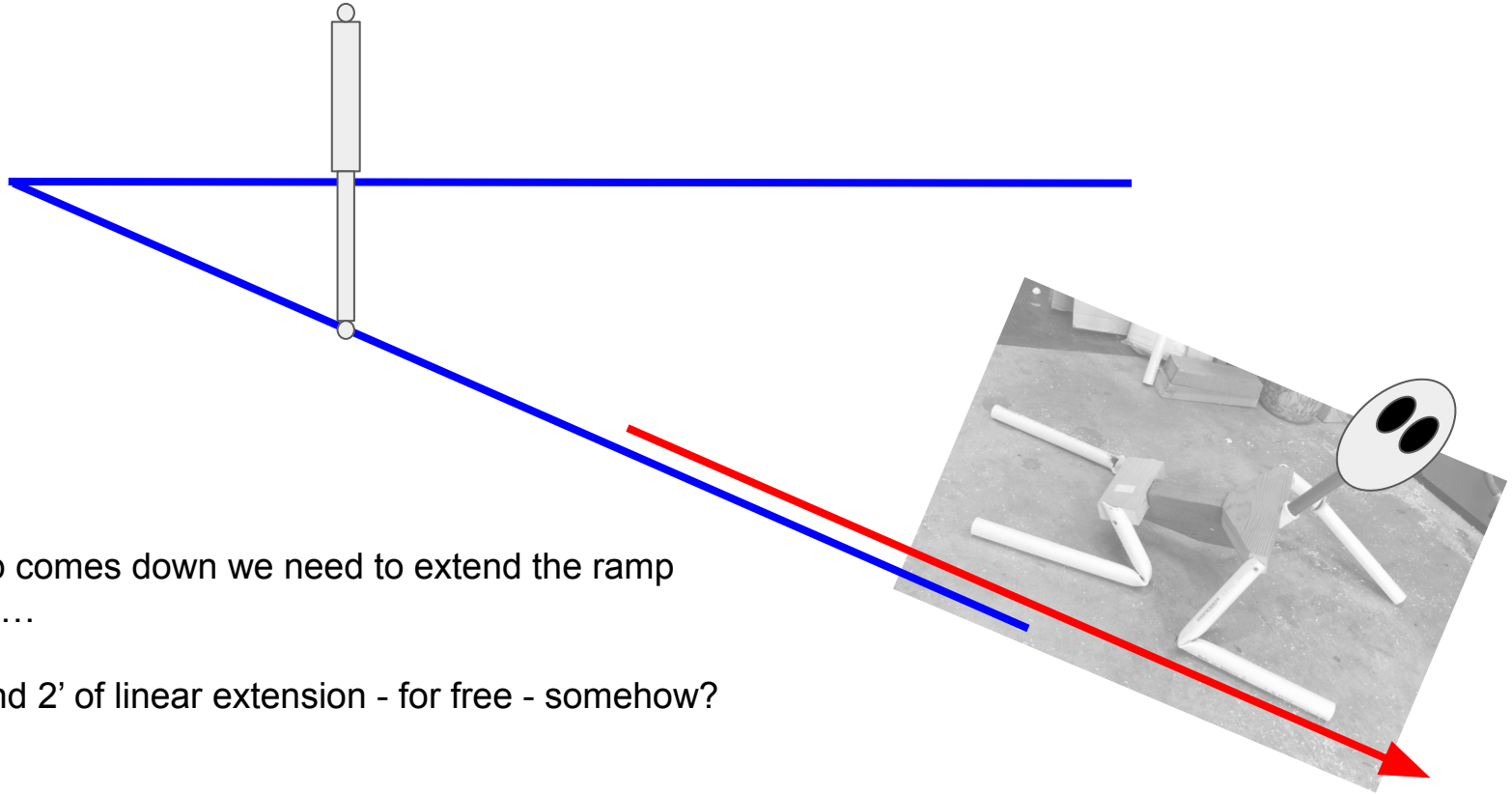


Volt	Stroke Length	Stroke Length	Retracted Length	Retracted Length	Extended Length	Extended Length
12V	100mm	4 in	205mm	8.07 in	350mm	12.01
12V	150mm	6 in	250mm	10.04 in	405mm	15.94
12V	200mm	8 in	320mm	12.60 in	520mm	20.47
12V	250mm	10 in	370mm	14.57 in	620mm	24.41
12V	300mm	12 in	420mm	16.54 in	720mm	28.35

Full load 3A each

Linear actuators

To think about

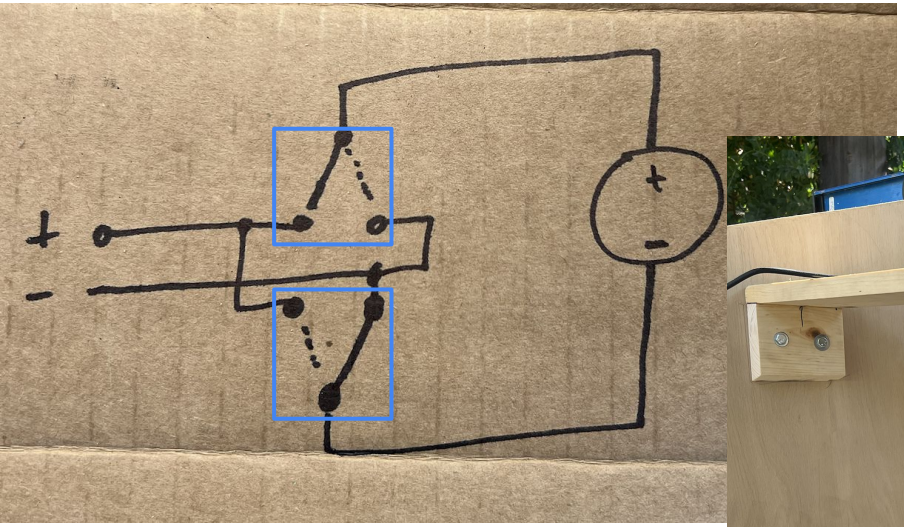


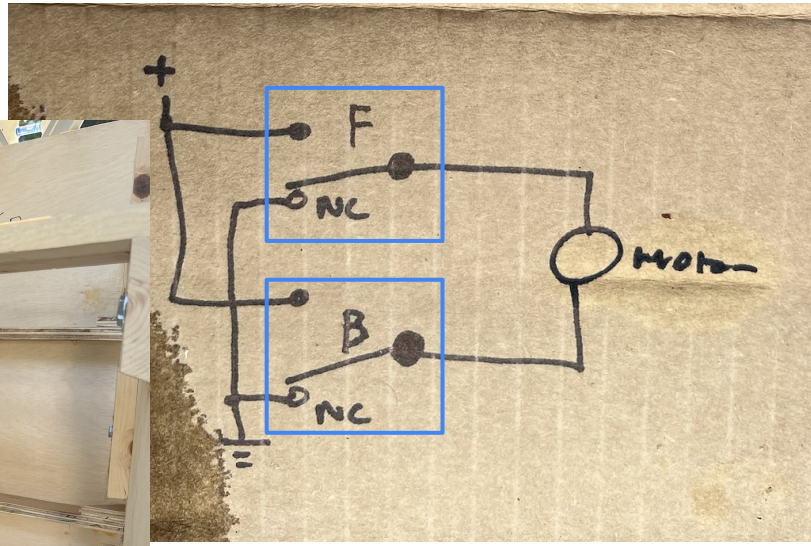
As the flap comes down we need to extend the ramp some how…

Have to find 2’ of linear extension - for free - somehow?

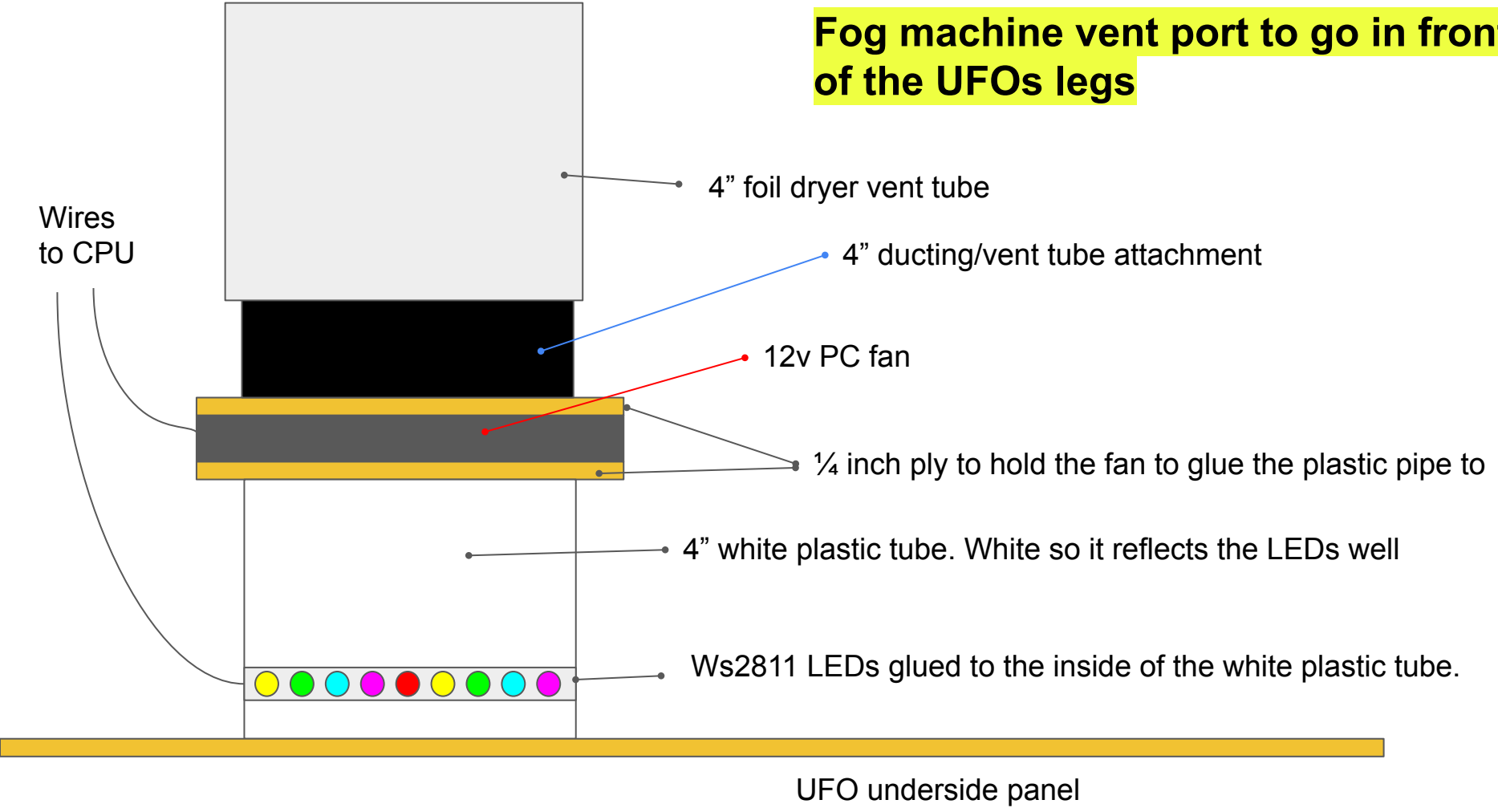
Linear actuator & wiring

This one is better as it has an off option and only flips one relay…

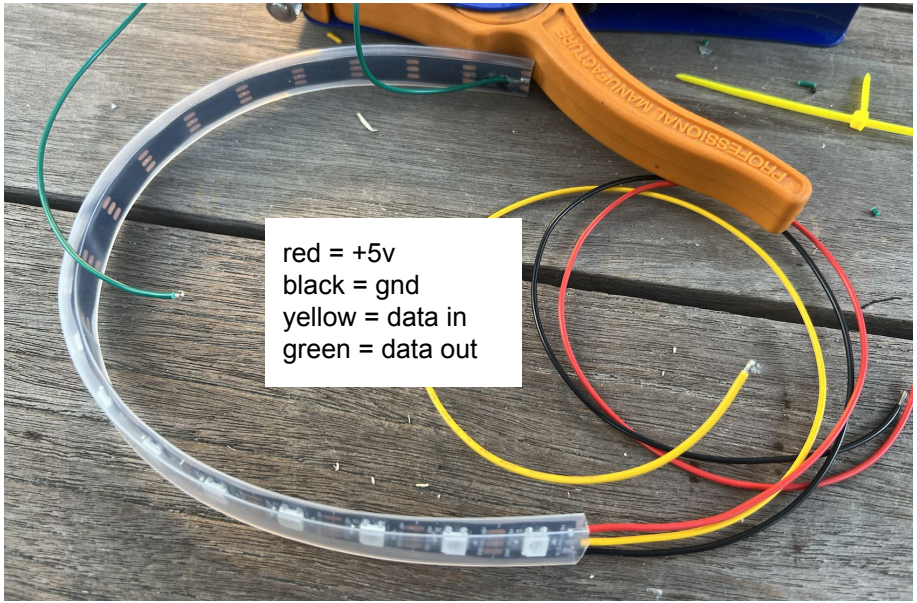


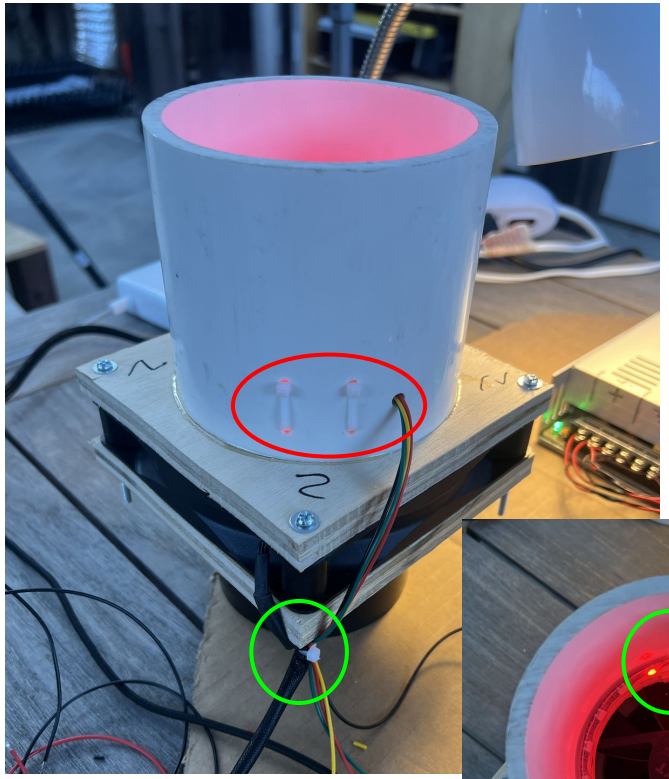


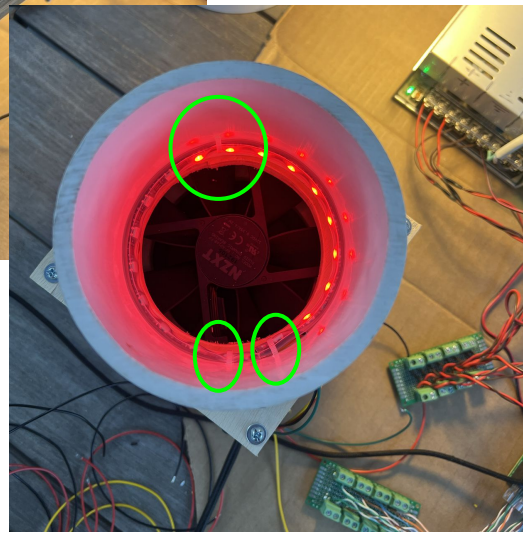
Fog machine vent port to go in front of the UFOs legs



The actual vent ports once assembled - plastic pipe and gorilla glue…







The LED strips are very fragile on their solder joints. I messed this assembly up a lot. Once the strips are made they are put in by shaping them into a circle smaller than the tube and held in a circle with a zip tie to lower it into the tube. This stops it springing apart and pulling on the wires and damaging the solder joints as your thread the wires through the holes and place the strip. Zip ties hold the strips in place and offer strain relief.

14” draw sliders used to make a lowerable platform for the electronics and to be able to get to the fog machine

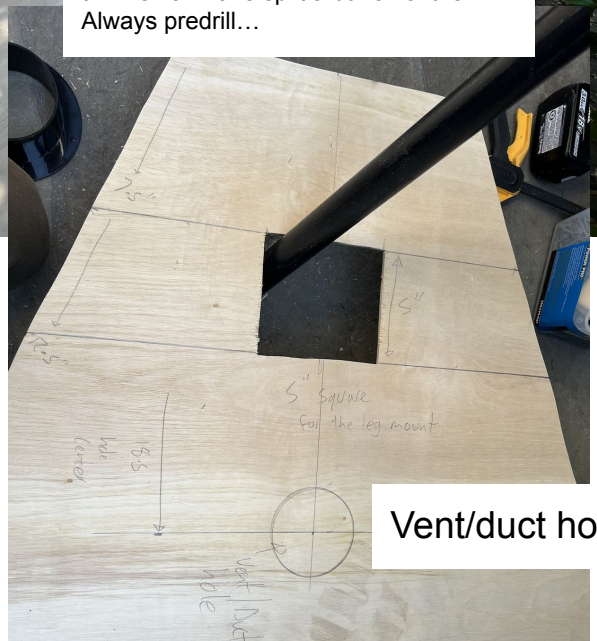
~~2 weeks left to get this done~~

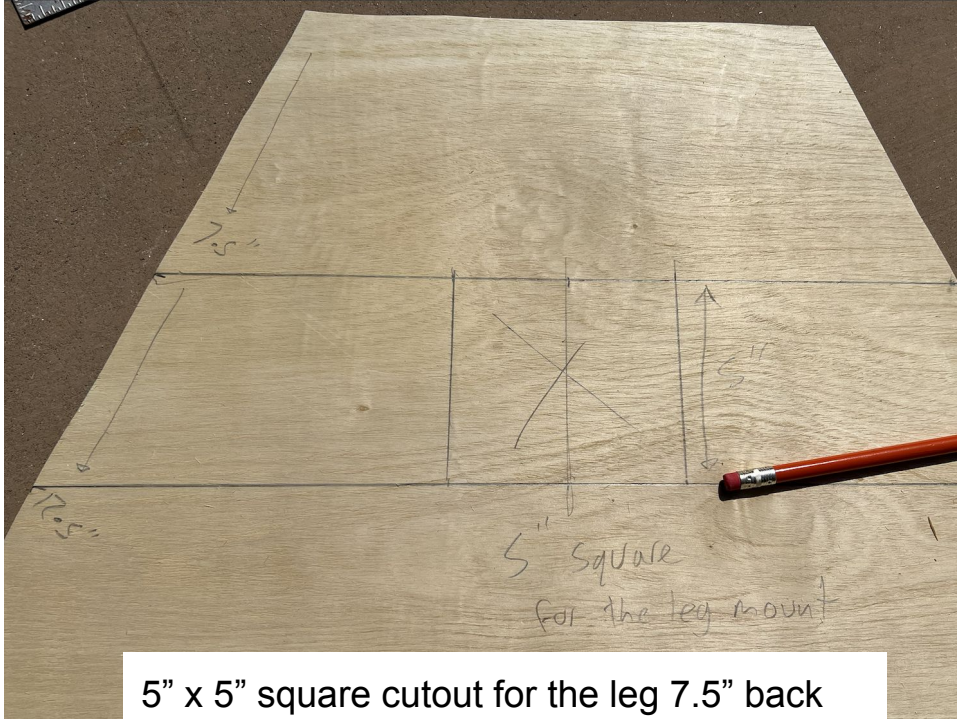
What's next?:

- make a 3v supply for the laser so I don't need batteries
- ~~add 2 12v power supplies~~
- ~~cut and place all the panel mounting strips~~
- move the dome fan to inside the fog segment - not going to do this this time
- ~~panel in the fog segment at the rear~~
- ~~cut the panel for the leg segment bottoms - these have cut out for legs and ducts/lights~~
- ~~figure out out to mount the leg ducts/lights - I dont want to glue them to the panel~~
- ~~center the dome and figure out a mounting method that covers the gaps~~
- ~~move the electronics to the lower platform and tidy and manage/restrain the wires~~
- ~~make the lower platform bolt attached to the drawer runner~~
- ~~make an led strip length and PSU plan~~
- make the pilot platform
- find a way to lock the platform up and in place
- figure out how to attach the dome - really don't have a plan for this

- got to get this build to a point when we can apply paint, water proofing and a shiny covering soon
  - once the panels go on it becomes less simple to disassemble and work on
- how will we lift this to the front yard? Make a trolley and strengthen some attachment points?
- how can I quickly fix it if breaks on halloween night - make it serviceable and have spares - what?
- a lot of stuff to do in code also tracked as comments there - make an event scheduler

Fog box duct and panel edges. They are thinnish a I have split a bunch of them. Always predrill…

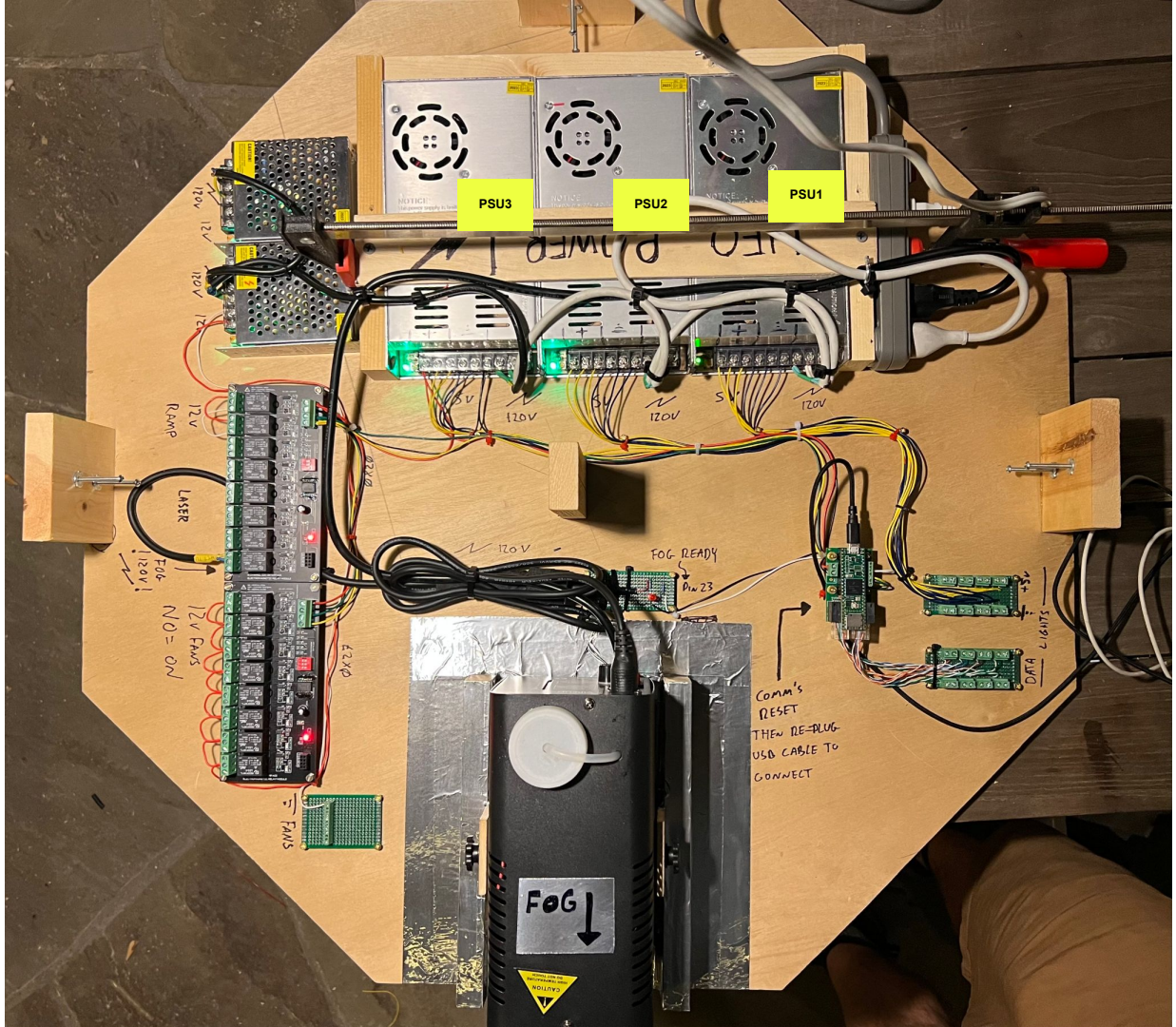




5” x 5” square cutout for the leg 7.5” back from inside edge

Vent/duct hole is 18.5” back from inside edge


This is where we are….



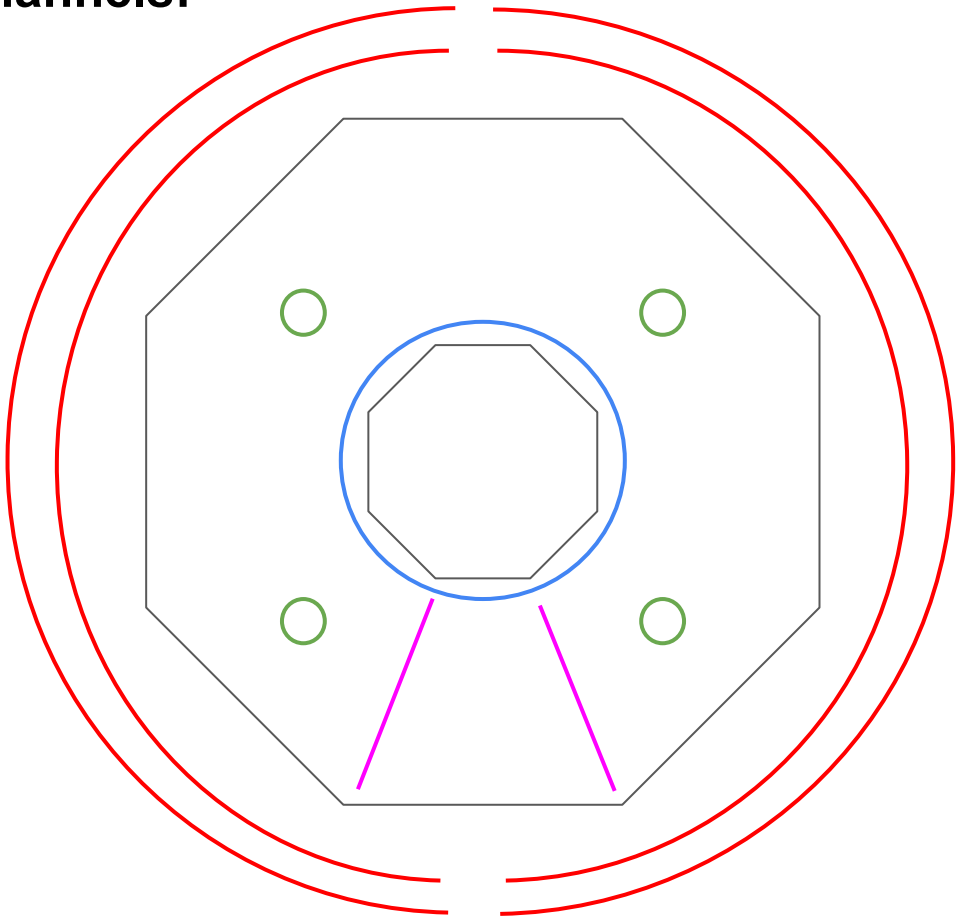
CPU and 5v electronics run from PSU3. Keep LED load spread across PSU1 & 2 as much as possible

PSUs are 300W - try to run at ⅔ capacity if possible (under 200W)

300 leds per channel and we have 8 channels:

90 Watts max per 300 LEDs full white bright

Where:	Channel:	PSU:
4x 300 LED segments for the outer rings	0,1,2,3	1,1 2,2
~150 LEDs in the dome ring	4	3
72 LED for 4 vents	5	3
~150 LEDs for the ramp edges	6	3



PSU1 ~= 2x90W = 180W PSU2 ~= 2x90W = 180W PSU3 ~= 1.25x90W = 113W

1.5 weeks left to get this done

What's next?:

- make a 3v supply for the laser so I don't need batteries
- ~~complete the wiring for the ducts/vents and ramp~~
- ~~attach the next batch of LED strips~~
  - ~~dome ring~~
  - ~~4x outer rings~~
  - ~~ramp strips~~
- ~~use the LED connectors?~~
- ~~move the dome fan to inside the fog segment~~
- ~~make the pilot platform~~
- cut the remaining 9 panels - 7 top side, 2 bottom side
- cut the ramp trim and figure out how how to finish the underside of the ramp
- get the ramp to the right height when closed
- ~~find a way to lock the platform up and in place (its heavier than I thought it would be)~~
- figure out how to attach the dome - really don't have a plan for this
- ~~pick primer and silver paint~~
- get the panels on and into a state where we are ready to paint
- write a lot of software
- Swap the channels for the ring LEDs 0<>2
- ~~common grounds for 5v and 12v PSUs~~
- ~~test the back left fan - seems slow~~
- ~~order a relay board and some spare LEDs~~

- ~~make a painting and scaling plan~~
- make a plan to lift and move the UFO
- ~~make a spares plan - 'what could break and what would be do?' list~~

If its breaks?	Critical	Spare	What to do: easy, pain, hard	Spares & repairs
Ramp actuator		yes, 1	Simple to replace by pulling the pins and reconnecting its wires. Accessed via the ramp and the electronics bay	
Vent fan		yes, 2	Have to remove a top segment panel to swap the fan out. Some soldering to rewire and some bolts to undo on the duct//fan unit.	
Dome fan			Remove a top segment panel for the fog box, remove the dome and/or reach in via the electronics bay	
Laser		no	Just swap it out. To 1st prep it: snip the red wire to disable the leveler; solder attach to the 3v / relay wires	
Vent LED ring		1 strip	Same as replace a vent fan + remake and refit the led strip per slide 35	
Dome LED ring			Have to reach the dome, probably need to remove two segment panels to reach in.	
Outer LED ring			Should be relatively easy if the power and data wires are easy to access	
Ramp LED strip			Should be relatively easy if the power and data wires are easy to access	
5V PSU	**Yes**	yes-ish	We are under 900W of capacity and are running at approx 450W. Each to access - needs care to balance the load. Have some good-enough spares in push.	
12V PSU	**Yes**	yes-ish	We have 10A of capacity and ~4A of load, so we have redundancy. Easy to access and move wires. Have some good-enough spares in push.	
CPU	**Yes**	yes,1	Swap it out, unplug it, and reload the software. Needs connectors to be added. I have some connectors.	
LED adapter card	**Yes**	yes,1	Unscrew it, unplug it. Needs connectors to be added. I have some connectors.	
Relay board	**Yes**	yes,1	Easy to access and replace - just replace	
Screw term' boards		no	This is custom built - easy to take out and fix or make a new one	
Fog ready board		no	This is custom built - easy to take out and fix or make a new one	
Fog machine		no	Easy to replace - just take it out and put a replacement in.	

A few more parts listed out

8 Channel I2C Relay Module	from amazon
WS2812B LED strips	from amazon
PC fans	from amazon
300W 5V PSU	from amazon
Sweeping laser	from amazon
60W 12V PSU	from amazon
Linear actuator	from amazon
WS2811B Teensy adapter	from amazon
Teensy CPU board	from amazon
4” ducting flange	from amazon
4” ducting	from amazon
Fog machine	from amazon

1 week left to get this done

What's next?:

- ~~make a 3v supply for the laser so I don't need batteries~~
- ~~mount the laser to good effect~~
- swap the channels for the ring LEDs 0<>2
- find and fix the fog blower leak
- battery pack for AAs added
- ~~route the data out line into the ramp bay, also route in some power, for future use~~
- fit 2 8x8 neopixel matrices into the ramp bay

- cover the sliding bolt holes on the bottom
- ~~cut the remaining 5 panels - 3 top side, 2 bottom side~~
- ~~cut the ramp trim and figure out how how to finish the underside of the ramp~~
- ~~get the ramp to the right height when closed~~
- ~~figure out how to attach the dome - really don't have a plan for this~~
- ~~get the panels on and into a state where we are ready to paint - get them off and level~~
- power cable up a rear leg - nice to have…

- write a lot of software - doing good here now finally

- ~~make a painting and scaling plan~~
- make a plan to lift and move the UFO

How I built an event scheduler in software

Scheduler Overview

Core Data Structures:

- `Event`: This represents a single scheduled activity. It contains:
  - `startTime` and `endTime`: Time markers (in milliseconds since the sequence start) to determine when an event should start and stop.
  - `function`: A function pointer representing the activity or effect to run.
  - `params`: Any parameters that should be passed to the function.
  - `continuous`: A boolean to specify if the event function should run continuously between `startTime` and `endTime` or just once.
  - `hasRun`: A flag to ensure one-time events only run once.
  - `functionName`: A string representation of the function's name for debugging purposes.
  - `conditionalOnSysReady`: A flag to specify if the event should run conditionally based on the `sys_ready` variable.
- `Sequence`: A collection of events that should run in a specific order. It contains:
  - `events`: An array of `Event`.
  - `numEvents`: Number of events in the sequence.
  - `duration`: Total duration of the entire sequence.
  - `repeatCount`: Number of times the sequence should repeat.
  - `currentCount`: A counter to track how many times the sequence has run.

Scheduler Logic:

- The scheduler works in the `loop()` function, continuously checking the current time against the start and end times of each event in the active sequence.
- If the current time is within an event's active window (between its `startTime` and `endTime`):
  - For one-time events, the event's function is executed once and `hasRun` is set to `true`.
  - For continuous events, the function is executed in every loop iteration during its active window.
  - If an event is conditional on `sys_ready`, it checks the value of `sys_ready` before execution.
- After executing an event's function, the scheduler checks if the current sequence's duration has been exceeded:
  - If the sequence has been repeated less than `repeatCount` times, the sequence restarts.
  - Otherwise, the scheduler moves to the next sequence.

Dynamic Adjustments:

- The `startTime` and `endTime` of events can be dynamically adjusted based on user input or other conditions.
- The `sys_ready` variable can be toggled to conditionally enable or disable certain events.

To use the scheduler:

Usage:https://github.com/ss023459/UFO/blob/main/main6.ino

Define your event functions.
Create an array of `Event` structures for each sequence.
Create an array of `Sequence` structures to define the order and repetition of sequences.
In the `loop()`, the scheduler will handle the execution of events based on their defined criteria.

The design ensures a non-blocking behavior where events are executed based on the system's millisecond timer without relying on `delay()`, making it responsive and adaptable to dynamic changes.

```
void loop() {

  unsigned long currTime = millis() - seqStart;

  Sequence& currentSequence = sequences[currentSequenceIndex];
  Event* currentEvents = currentSequence.events;

  for (int i = 0; i < currentSequence.numEvents; i++) {
    if (currTime >= currentEvents[i].startTime && currTime < currentEvents[i].endTime) {
      if (currentEvents[i].continuous) {
        currentEvents[i].startFunction();
      } else if (!currentEvents[i].startHasRun) {
        currentEvents[i].startFunction();
        currentEvents[i].startHasRun = true;
      }
    } else if (currTime >= currentEvents[i].endTime) {
        if (!currentEvents[i].endHasRun) {
          currentEvents[i].endFunction();
          currentEvents[i].endHasRun = true;
        }
    }
  }

  if (currTime >= currentSequence.duration) {
    currentSequence.currentCount++;
    for (int i = 0; i < currentSequence.numEvents; i++) {
      currentEvents[i].startHasRun = false;
      currentEvents[i].endHasRun = false;
    }
    if (currentSequence.currentCount >= currentSequence.repeatCount) {
      currentSequence.currentCount = 0;
      currentSequenceIndex = (currentSequenceIndex + 1) % (sizeof(sequences) / sizeof(Sequence));
    }
    seqStart = millis();
  }

  isFogReady();
  leds.show();

}
```

Scheduler and event, sequence structure

```
Event seqRampLanding[] = {
  {0, 15000, fogOn, fogOff},
  {3000,30000, domeFanOn, domeFanOff},
  {3000,20000, domeLightsOn, domeLightsOff},
  {10000,60000, randomRingBlips, ringsClear, CONT},
  {18000,74500, rampLightsMoving, rampLightsOff, CONT},
  {19000,74500, laserOn, laserOff},
  {20000,40000, rampDown, rampOff},
  {20000,75000, rampFanOn, rampFanOff},
  {60000,75000, rampUp, rampOff}
};

Event testRamp[] = {
  {0,15000, rampDown, rampOff},
  {17000,32000, rampUp, rampOff},
};

Event seqThrusters[] = {
  {0, 500, fogOn, fogOff},
  {0, 12500, domeFlyRedYellow, domeClear, CONT},
  {500, 12500, randomDuctFanOn, randomDuctFanOff},
  {2500, 12500, randomDuctLightOn, randomDuctLightOff, CONT}
};

Event seqLanding[] = {
  {2000, 20000, allDuctFansOn, allDuctFansOff},
  {0, 2000, fogOn, fogOff},
  {4000, 18000, allDuctLightsStrobe, allDuctLightsOff, CONT},
};

Sequence sequences[] = {
  {seqThrusters, sizeof(seqThrusters) / sizeof(Event), 12500,10,0},
  {seqLanding, sizeof(seqThrusters) / sizeof(Event), 20000,1,0},
  //{testRamp, sizeof(testRamp) / sizeof(Event), 32000, 1, 0}
  {seqRampLanding, sizeof(seqRampLanding) / sizeof(Event), 75000,1,0}
};
```

This is how you program sequences on the UFO

```
struct Event {
  unsigned long startTime;
  unsigned long endTime;
  void (*startFunction)();
  void (*endFunction)();
  bool continuous = false;
  bool startHasRun = false;
  bool endHasRun = false;
};
const bool CONT = true;

struct Sequence {
  Event* events;
  int numEvents;
  unsigned long duration;
  int repeatCount;
  int currentCount;
};
```

```
int rndDuctNum = 0;
boolean rndDuctNumSet = false;
void randomDuctFanOn() {
  if (!rndDuctNumSet) {
    rndDuctNum = random(4);
    rndDuctNumSet = true;
  }
  runFan(rndDuctNum, true);
}

void randomDuctFanOff() {
  rndDuctNumSet = false;
  runFan(rndDuctNum, false);
}

unsigned long rdlMS = 0;
void randomDuctLightOn() {
  if (millis() - rdlMS > 30) {
    int r = random(255);
    for (int j=0; j<18; j++) {
      leds.setPixel(ledCH5+j+(rndDuctNum*18),255,r,0);
    }
    rdlMS = millis();
  }

}

void randomDuctLightOff() {
  for (int j=0; j<18; j++) {
    leds.setPixel(ledCH5+j+(rndDuctNum *18),0,0,0);
  }
}
```

***startFunction examples:**

It's too messy to pass params between functions that are running concurrently. So set them globally instead.

***Note** - teensy octws211b libaries arent memory safe so dont use them for LED state reads*

Using ChatGPT to quickly get templates for lighting effects:

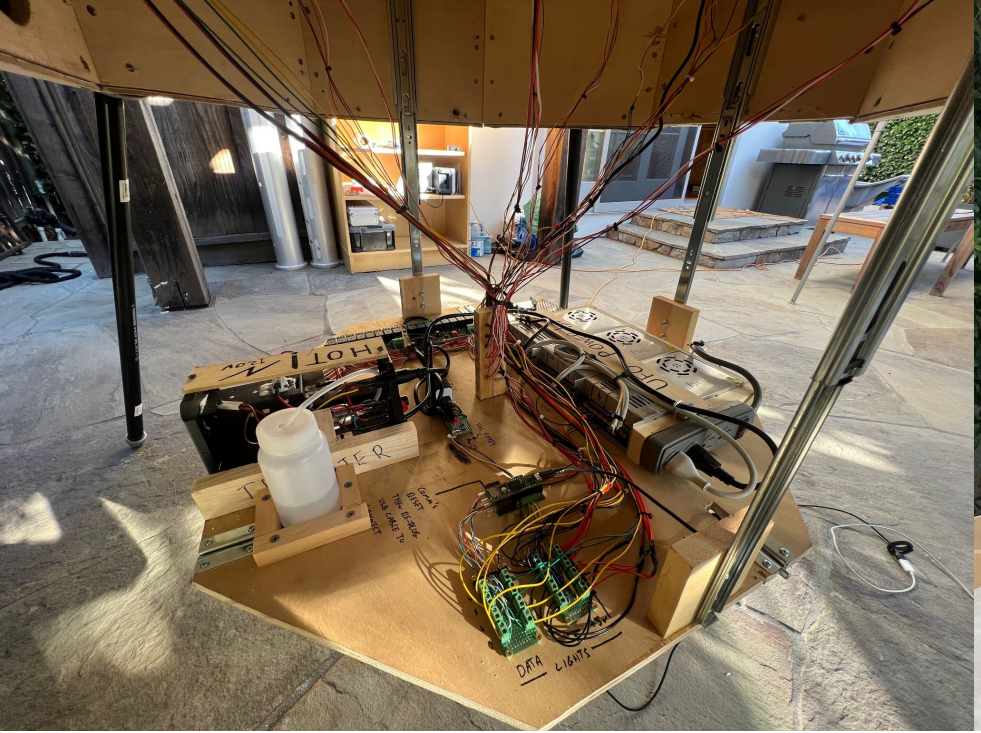
https://chat.openai.com/share/abb4405a-aa00-4ea9-b9ff-25c320b82b9d
https://chat.openai.com/share/95dcf567-c69e-4572-8338-a50dd7879396

Code that pretty much fully exercises all of the UFO components

```
#include <OctoWS2811.h>
#include <Wire.h>

boolean clearUFO = false;

enum relayPos {NC,NO};
relayPos relayState[16] = {NC,NC,NC,NC,NC,NC,NC,NC,NC,NC,NC,NC,NC,NC,NC,NC};
enum rampMode {OFF,DOWN,UP};

const int ledsPerStrip = 300;

DMAMEM int displayMemory[ledsPerStrip*6];
int drawingMemory[ledsPerStrip*6];
const int config = WS2811_GRB | WS2811_800kHz;
OctoWS2811 leds(ledsPerStrip, displayMemory, drawingMemory, config);

int fogPin = 23;
int fanLocs[8] = {7,6,5,4,3,2,1,0};
int fogLoc = 8;
int laserLoc = 11;
int rampLoc[2] = {14,15};

int ledCH0 = ledsPerStrip * 2; // ring swapped
int ledCH1 = ledsPerStrip * 1; // ring
int ledCH2 = ledsPerStrip * 0; // ring swapped
```

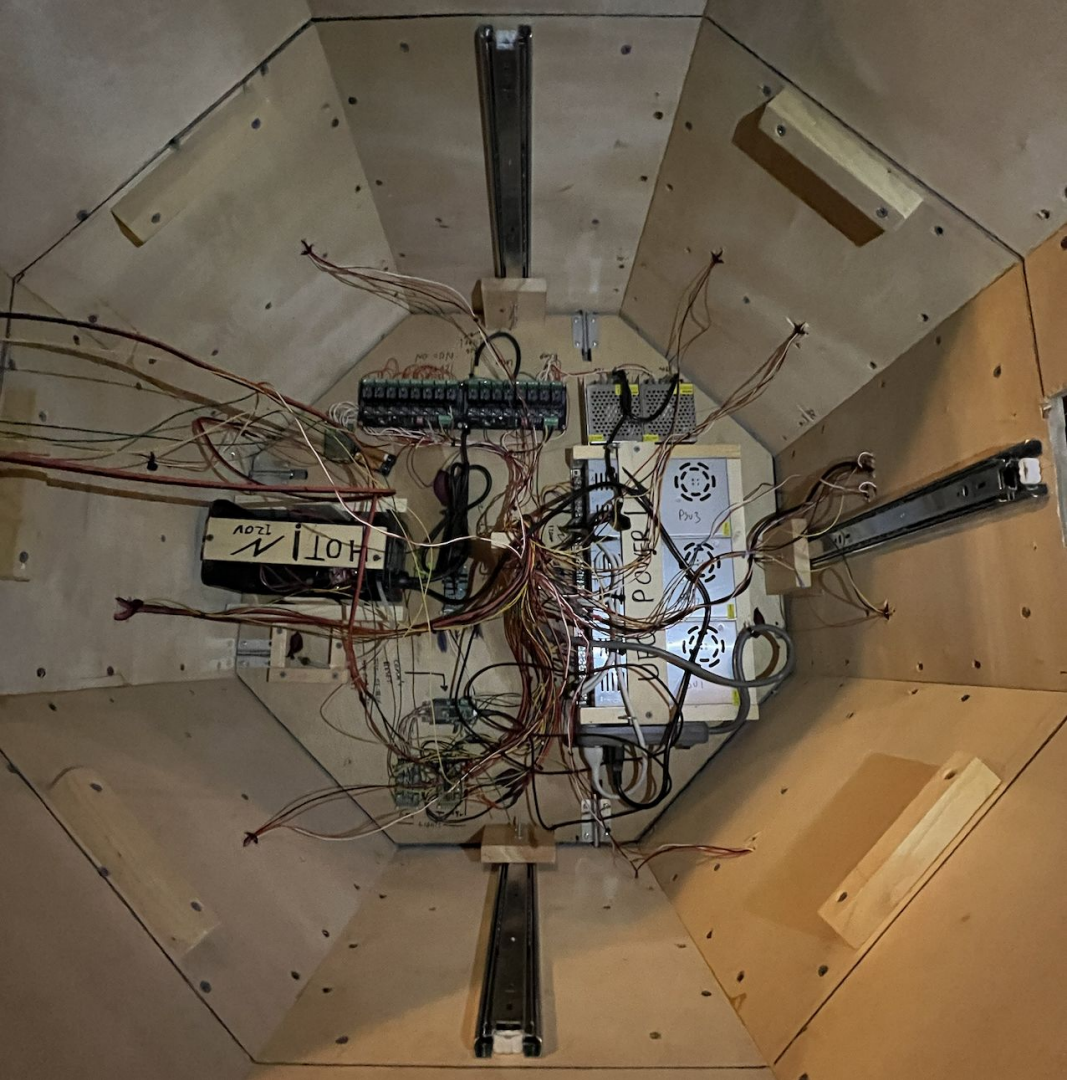
Original idea..

…nearly finished state…



The alien pilot fits - phew :)

…nearly finished state…



Where the wires settle when closed.

Final covering applied

This is adhesive aluminum foil cut and stuck in place.

Its not a great solution so each panel is stapled along the edges

In place and lit up

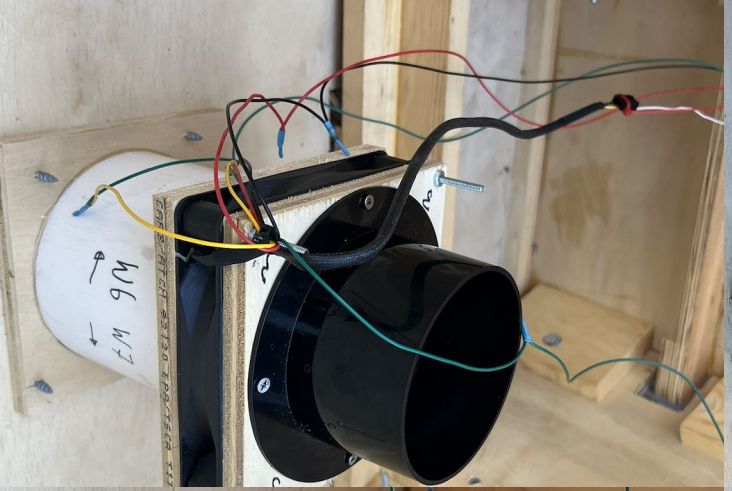
https://youtu.be/jFsSAoTA9vY

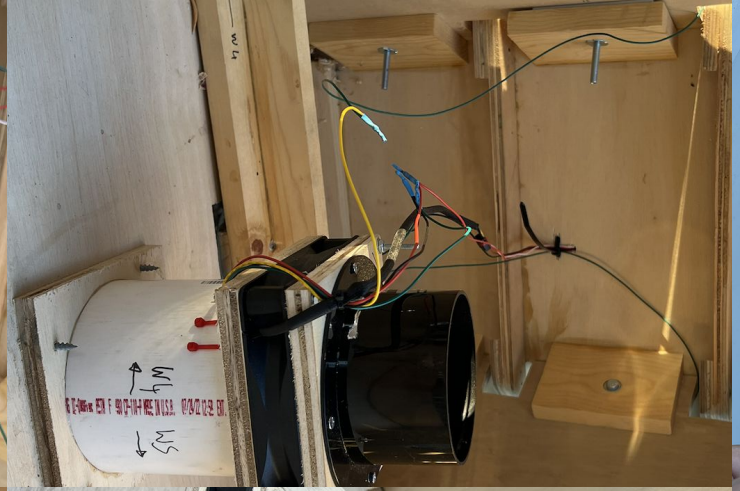
In place and lit up

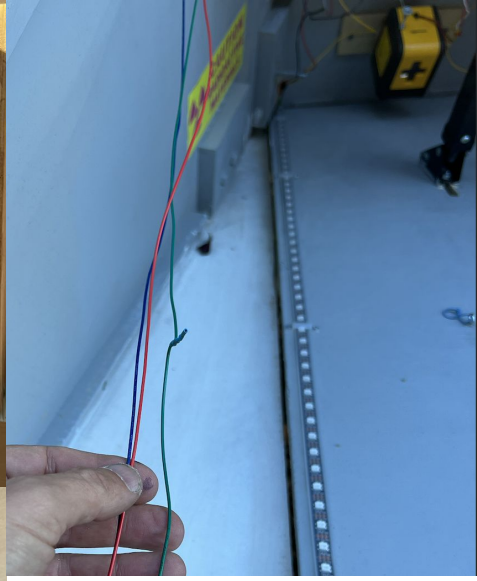
https://youtu.be/jFsSAoTA9vY

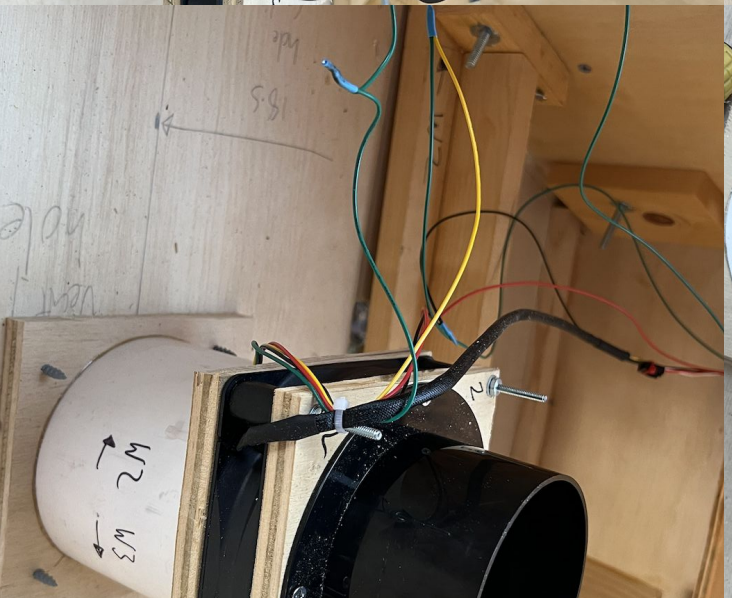
In place and lit up

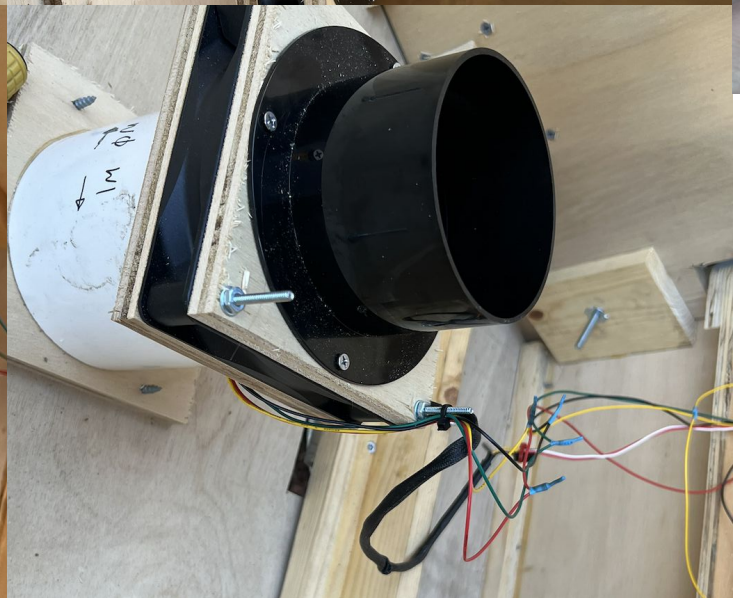
https://youtu.be/jFsSAoTA9vY











I snipped these wires to disassemble them. For ref…

The disassembled state ready for storage until next year

Note from disassembly - to do next year:

Need to add in connectors for the ducts/fan wiring - easier disassembly

One of the leg structs lock/embedded nuts has fractured the wood - find it.

The panels need stapling along all their edges.

The underside panels need spraying - second coat to add more shine.

The pilot needs mounting at the right height and fixing in.

The outer LED rings need connectors.

…Also some are damaged and need replacing.

Christmas color software and some new routines if I can. Then I can leave it out longer.

A bigger fog juice container would be worth doing too. Runs out after ~ 3 hours of use.