



A Sentient Wing: How to Build an Amatria Moth

Compiled during OurCS Hello Research 2018 Conference:

Augmented Reality Visualizations of IoT Data

Indiana University, School of Informatics, Computing, and Engineering, October 27, 2018

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Story of the Amatria Moth

Amatria, hanging above the stairs in Indiana University's Luddy Hall, is a luminous, forest-inspired landscape of soaring clouds and tangled thickets of 3D-printed formations alive with an artificial intelligence that invites visitors into an interactive, ethereal space. 'She' is a living sculpture with a delicate canopy of mesh- and frond-like organic structures suspended from the ceiling.

Amatria gathers information about her environment using light and motion sensors, responding with atmospheric sounds, undulating movements, and changing colors. She is aware of the people who enter her sphere to gaze upon her visual story of abiogenesis: the emergence of life during the earliest stages of development of the universe.

This Amatria Moth is a member of the newest generation of Amatria-related architectural elements, introduced in August of 2018. Take a Moth home as a conversation starter for discussing the brave new world where living architecture, clothing, and robots can speak, think, and interact with us and with each other (why is this interaction important? how does this interaction affect our future?)

Designed by Canadian architect Philip Beesley and built by the Cyberinfrastructure for Network Science at Indiana University.

For more information on Amatria, see <https://cns.iu.edu/amatria.html>

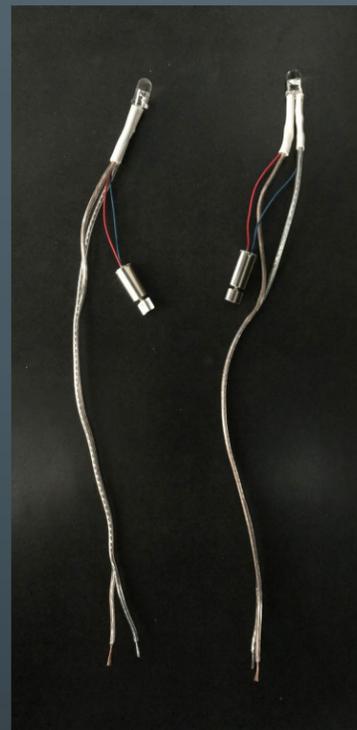
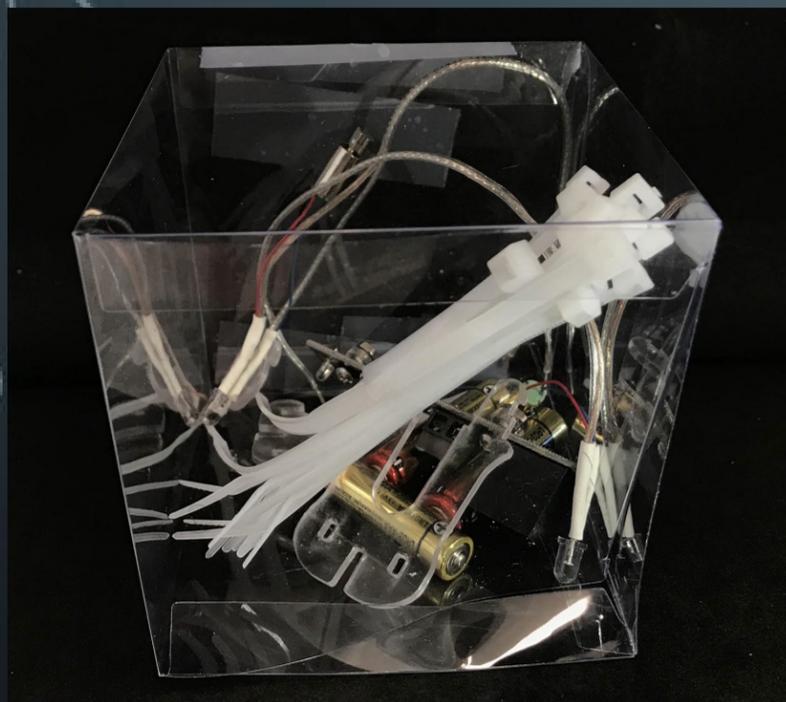
Why Build a Moth?

Moths are the newest generation of Amatria-related architectural elements. Moths are an interactive piece of the Amatria sculpture, using LED lights and vibrating motors with the intent to transform the relationship between AI and humans. It is limited experience and opportunity to create one of your very own. Building this model can help you better understand Amatria and how She works by creating an actuator similar to ones included in her structure. Watch as the vibrating motors interact with people and “flutter.”

Kit Assembly

Congratulations on your purchase of a Amatria Moth Kit!
To begin...

1. Make sure all parts are included in the kit based off the images below
2. Begin following the Step-by-Step Guide to create your Moth



Extruding Moth Base with “Spargate”: Part One



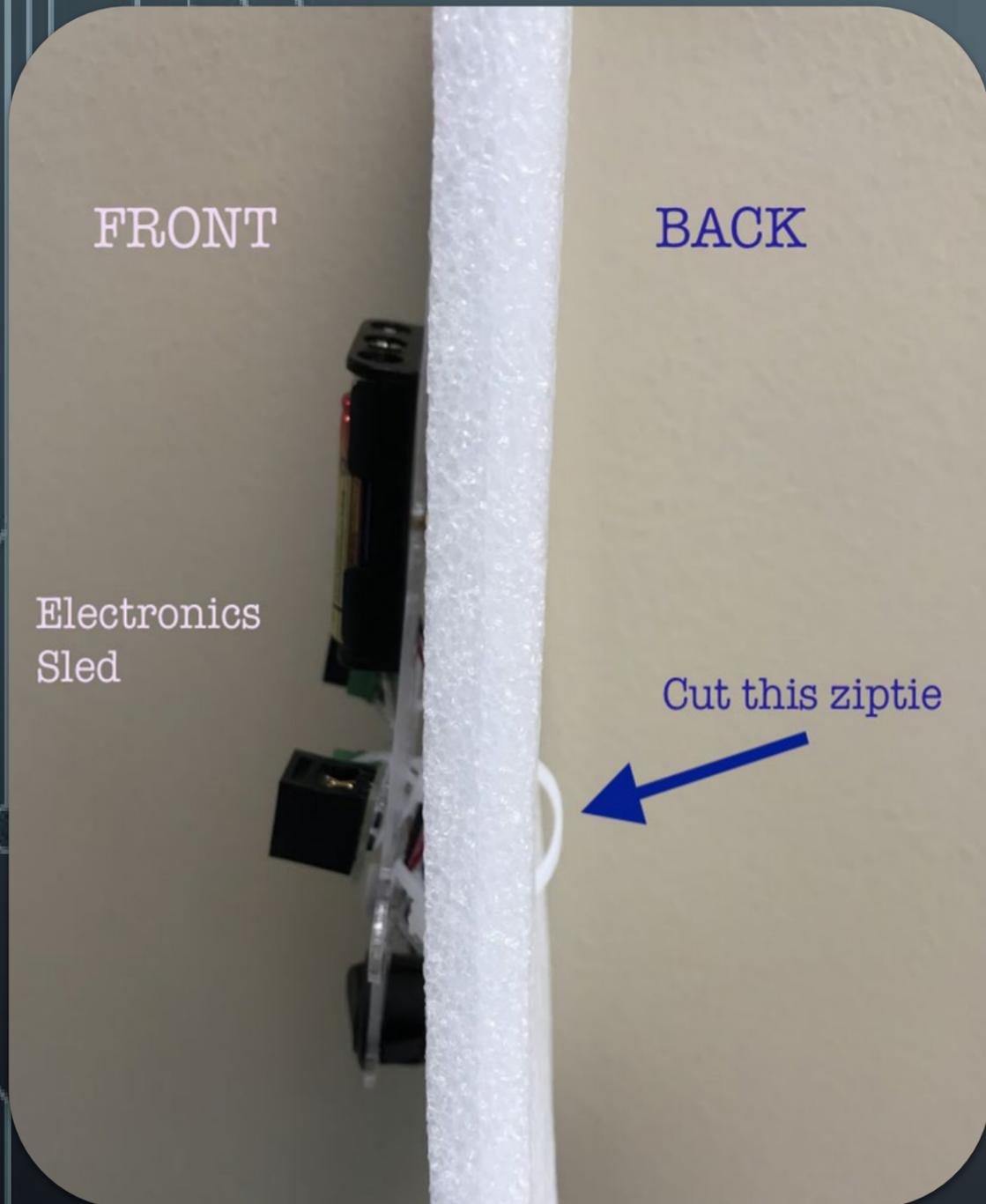
1. Preheat the oven to 400F on “broil” setting
2. Take note that the four corners of the mount plate are marked with letters A, B, C, and D.
3. Take off the three wing nuts from the mount plate
4. Take the flat acrylic spar piece and insert the hook nut. The thick wooden washer goes on the hook side. The large and steel washers and a nut go on the opposite side. Tighten the hook and the nut together.
5. Mount the acrylic/hook nut assembly on the three screws and tighten with the wing nuts.

Extruding Moth Base with “Spargate”: Part Two



6. Heat up the plate in the oven for approximately 2 minutes and 30 seconds.
7. Move the plate onto the SG (spargate) and make sure to match the A/B/C/D corners.
8. Slide the hook attached to the acrylic into the hook on the SG, step on the sides of the plate, and slowly pull up the hook until you hit the limit plate under the top of the SG.
9. Hold the rod for a few minutes to allow for the acrylic to cool down and harden.
10. Gently detach the hooks and unscrew the nut and remove the washers.

Assembly: Part One



The electronics sled comes almost fully assembled. To finish assembling this section, there are only three steps:

STEP 1

Cut the zip tie on the back of the plastic foam to remove the sleds from the foam.
(see diagram on the left)

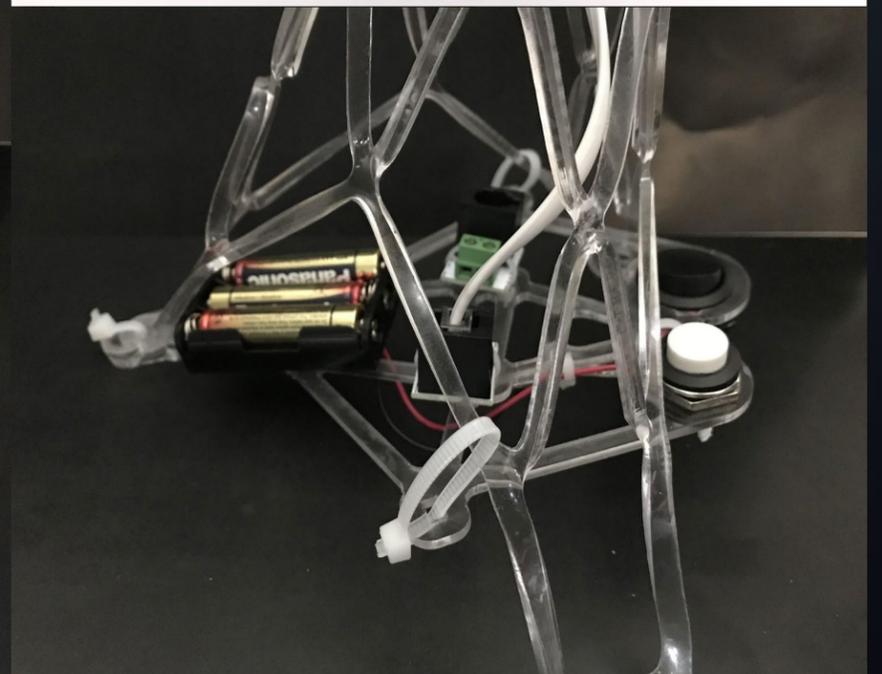
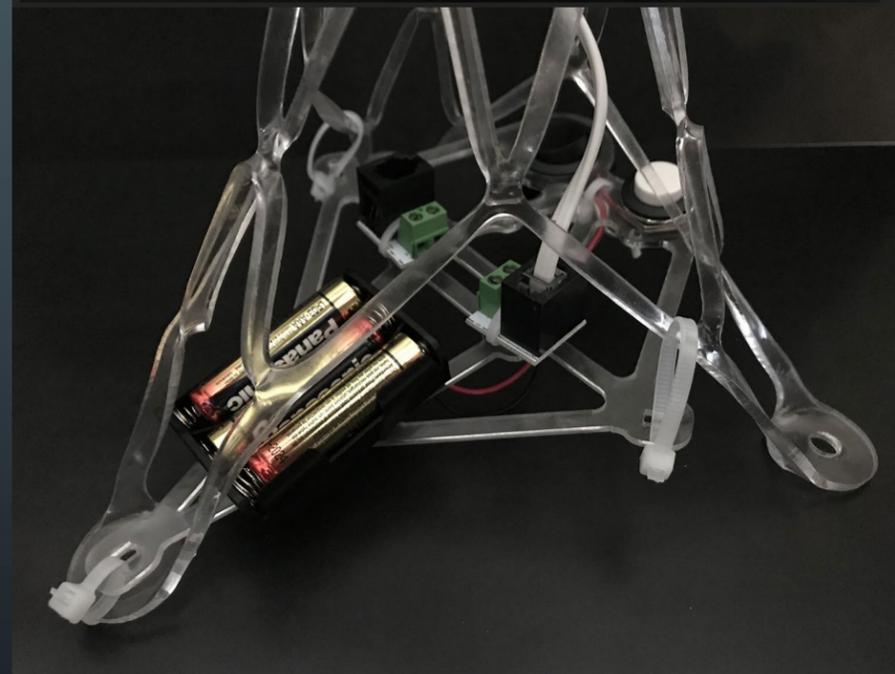
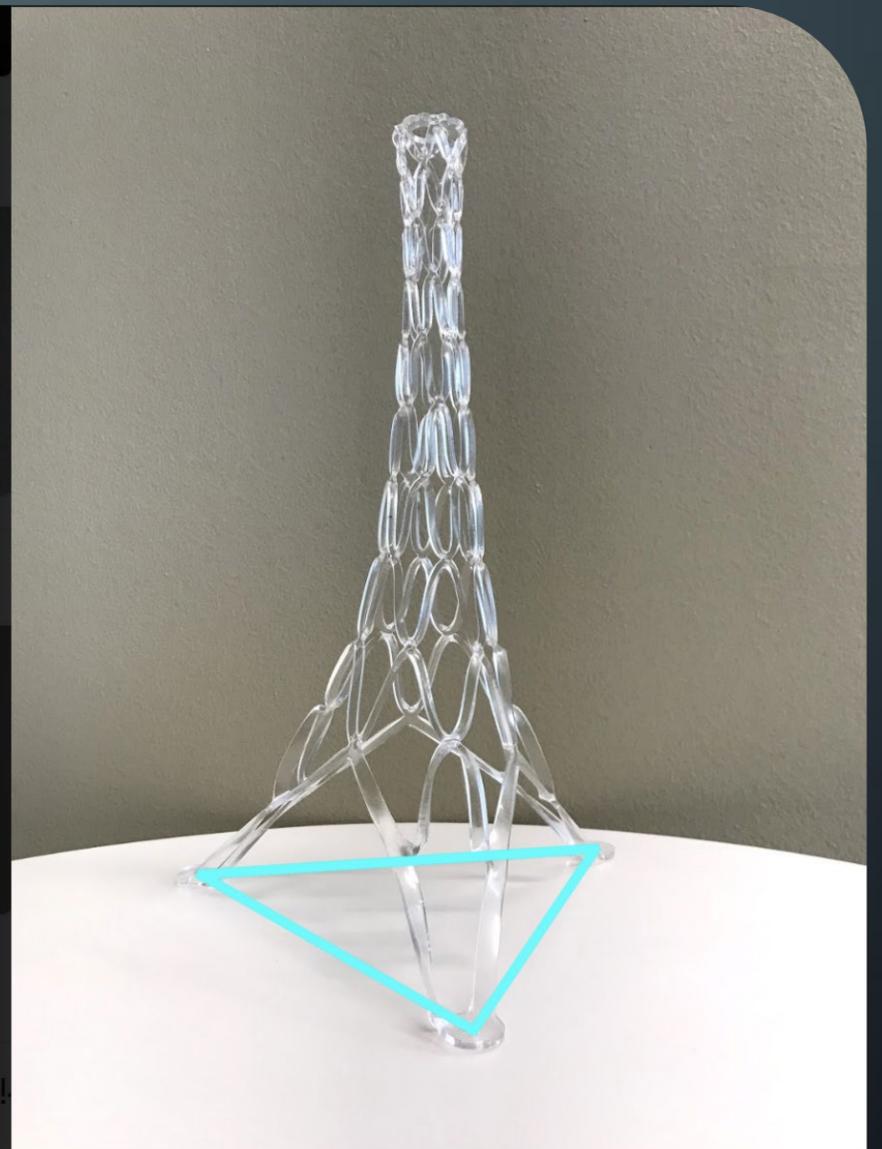
STEP 2

Insert three (3) AAA batteries into the battery pack.
(continued on next slide)

STEP 3:

There are two (2) sizes of zip ties: small and large. Use three (3) small zip ties to attach the electronics sled to the spar as pictured (see: How to Use a Zip Tie). Each corner of the “triangle” on the electronics sled should connect to a leg of the spar’s base.

Note: the electronics sled will not fit perfectly within the base of the spar (there might be some space between the two when you connect them with zip ties).



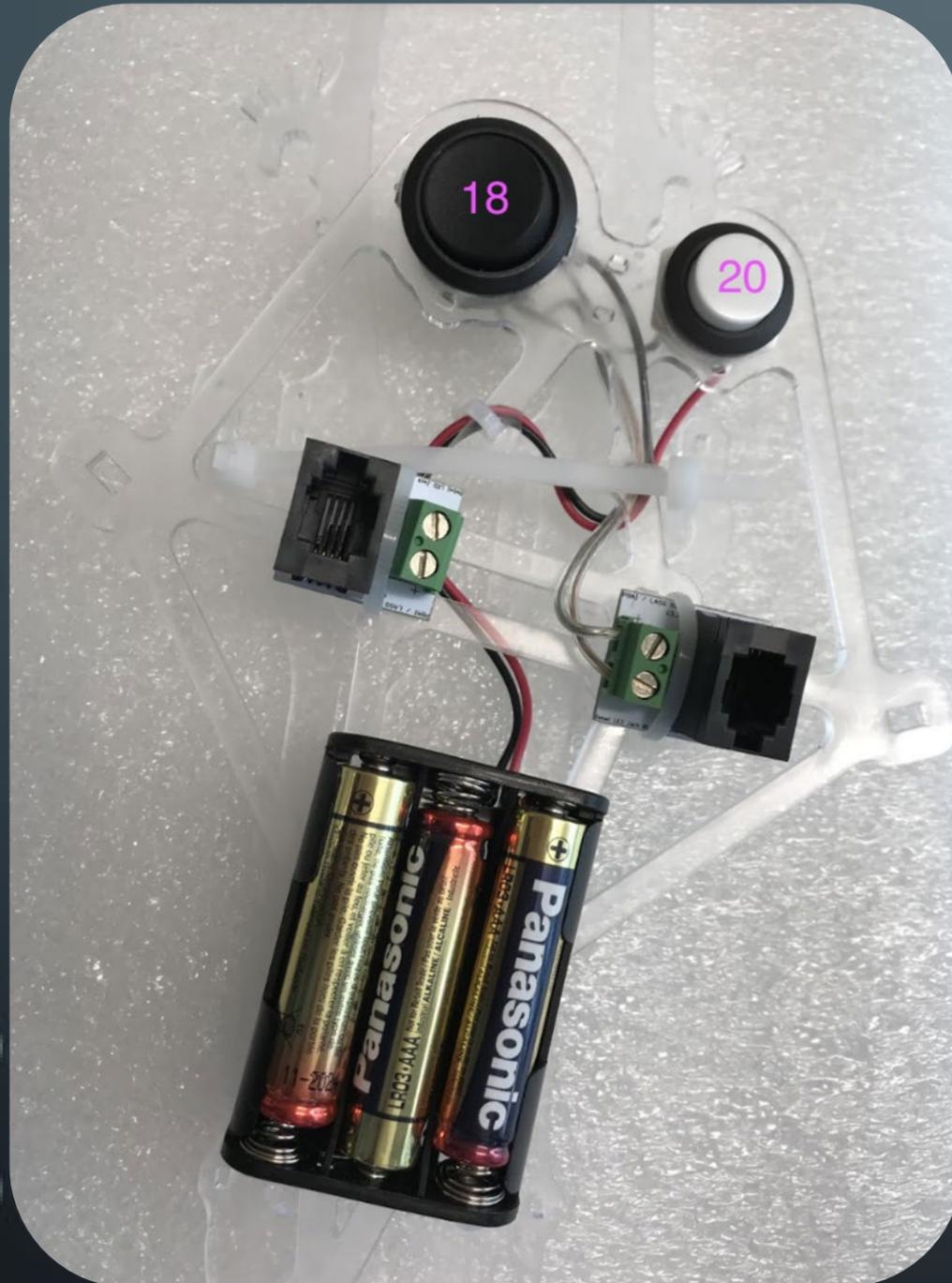
How to Use a Zip Tie

Loop the zip tie around the objects you want to tie together. Insert the pointed end of the zip tie into the square lock end and pull it through to tighten. Once the zip tie is secured, cut off the extra length hanging off the end.

Troubleshooting: if the pointed end does not fit into the square lock, try inserting it into the other side of the square lock.



The Electronics Sled



Explanation of parts

- The *momentary button* (#20, smaller and white) activates the LED and the motor (for vibration).
- Use the *DPDT switch* (#18, larger and black) to switch between the independent mode and the daisy chain mode.

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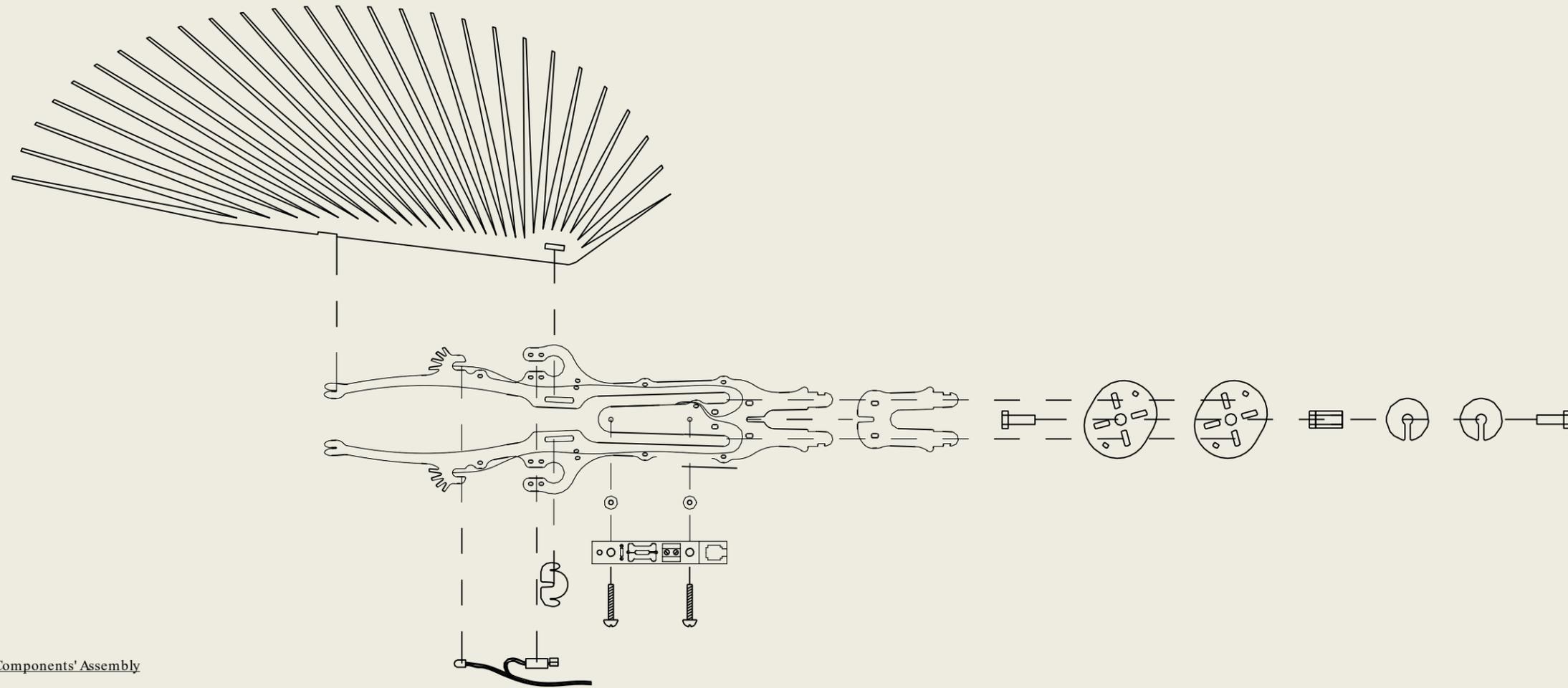
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Project
 Amatria Moth

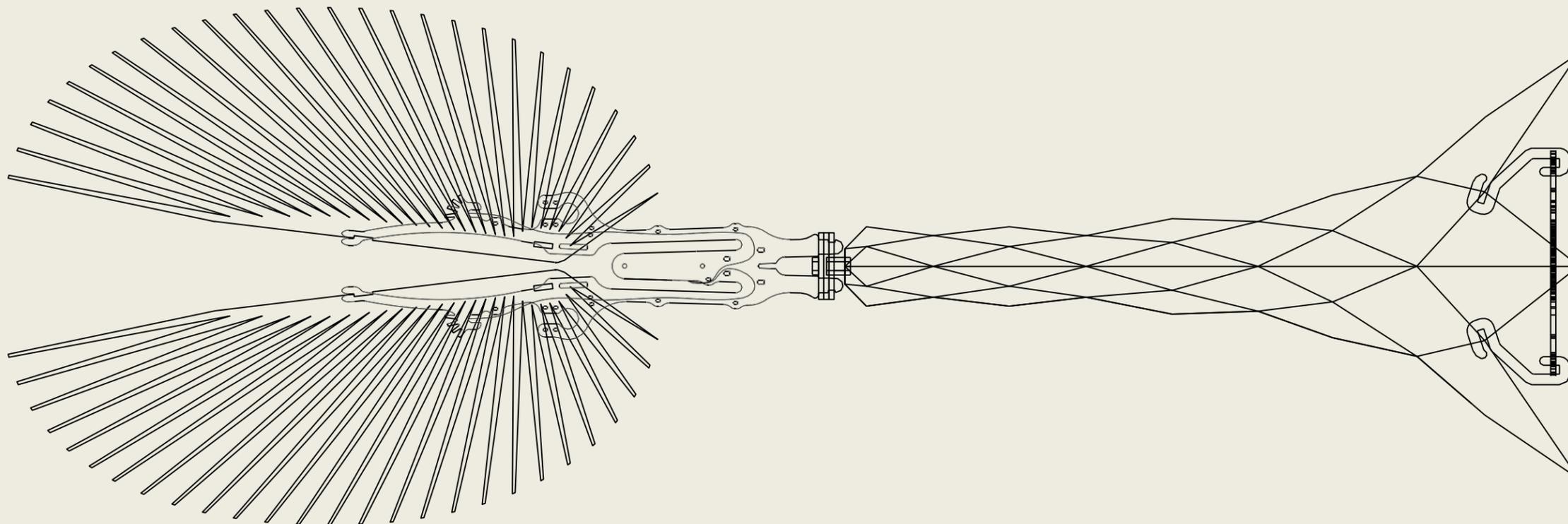
Drawing Title
 Amatria Moth Full
 Assembly

Drawing Scale

Sheet
 A10 1



2 Components' Assembly



1 Complete Assembly

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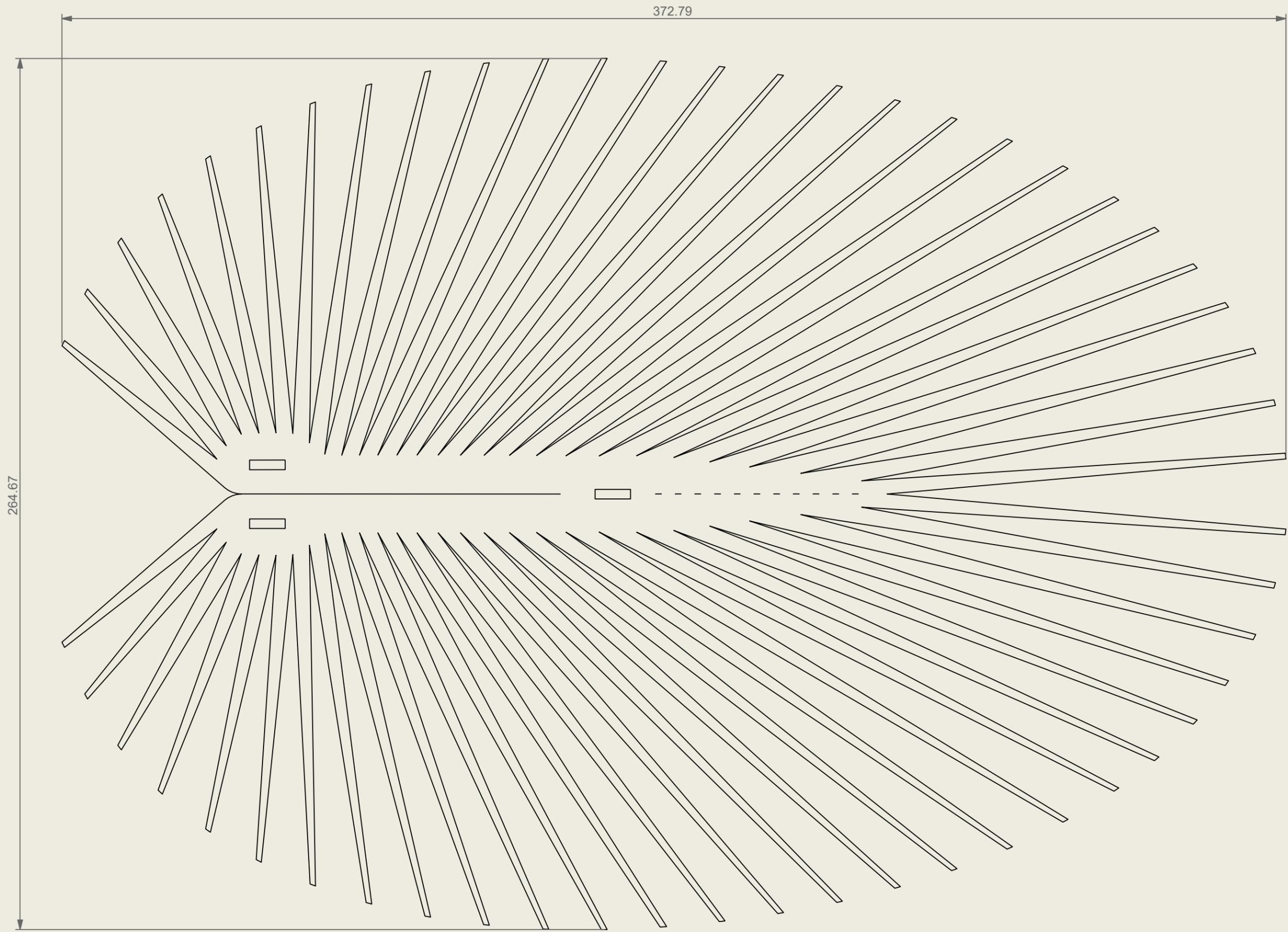
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Amatria Moth

Drawing Title
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Drawing Scale

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372.79

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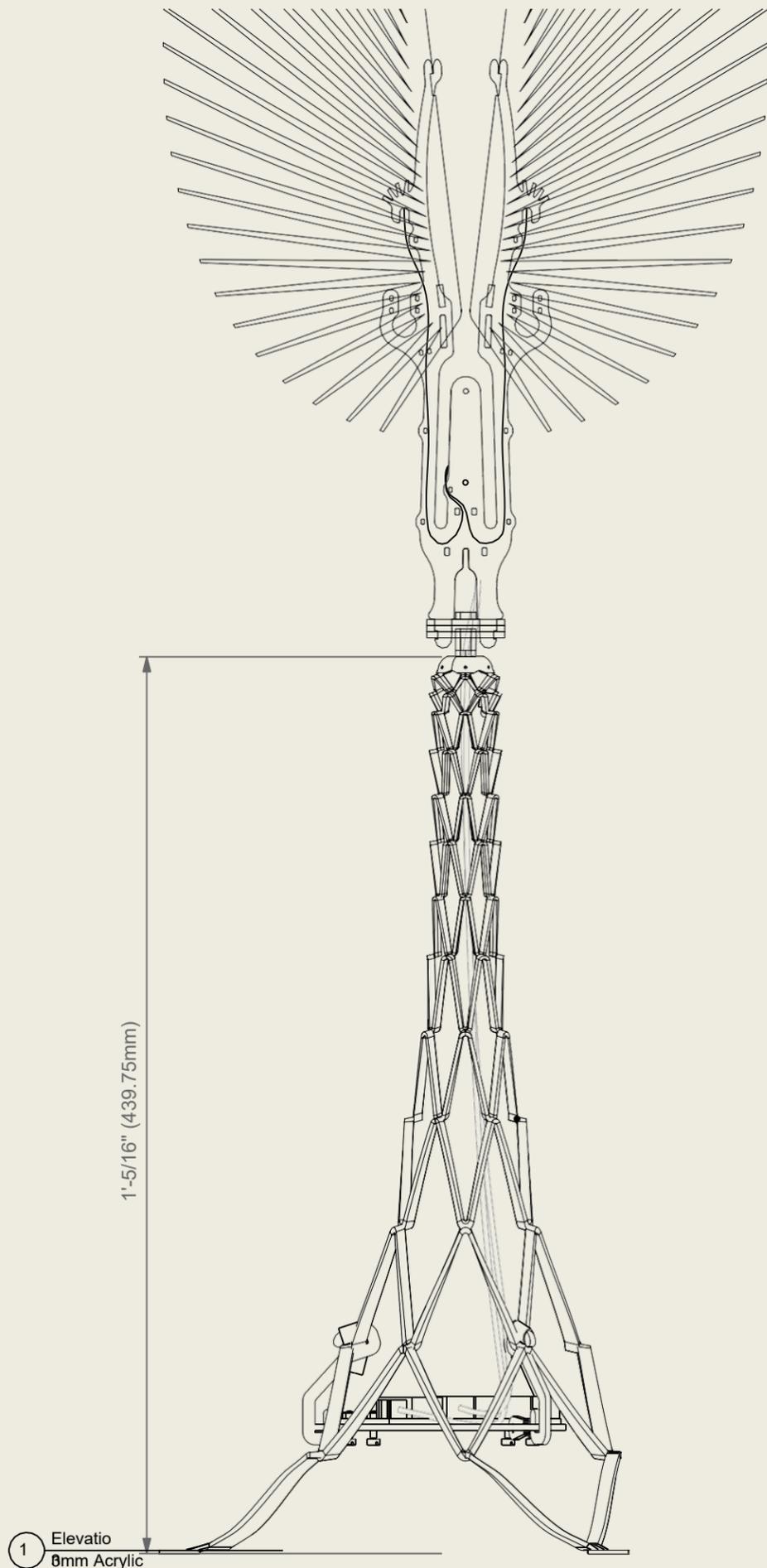
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Project
Amatria Moth

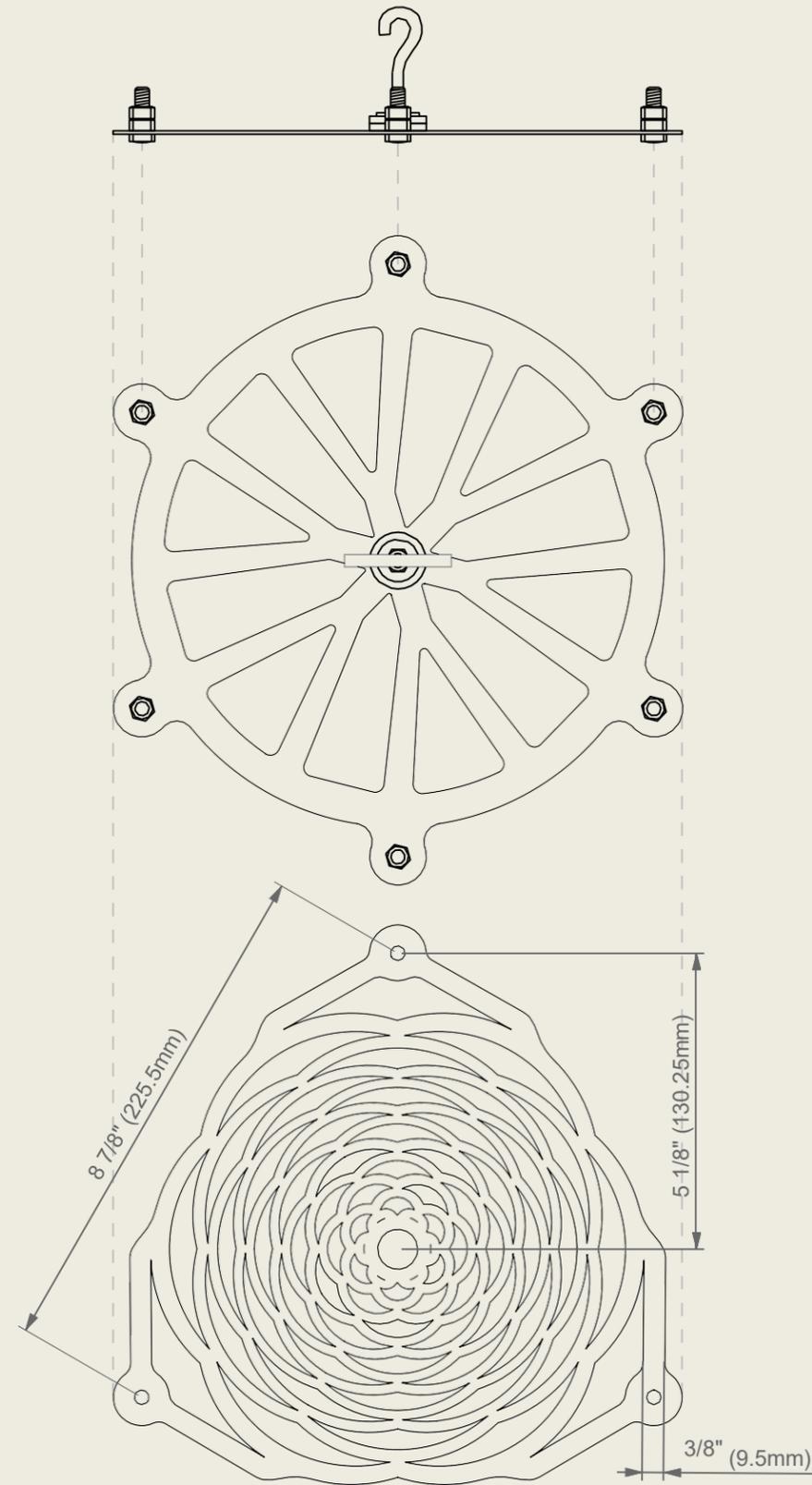
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Spar Detail

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2



1 Elevation
8mm Acrylic



2 Cutting Pattern and Forming Plate
3mm Acrylic Fastened to Steel Frame

PBAI / LASG

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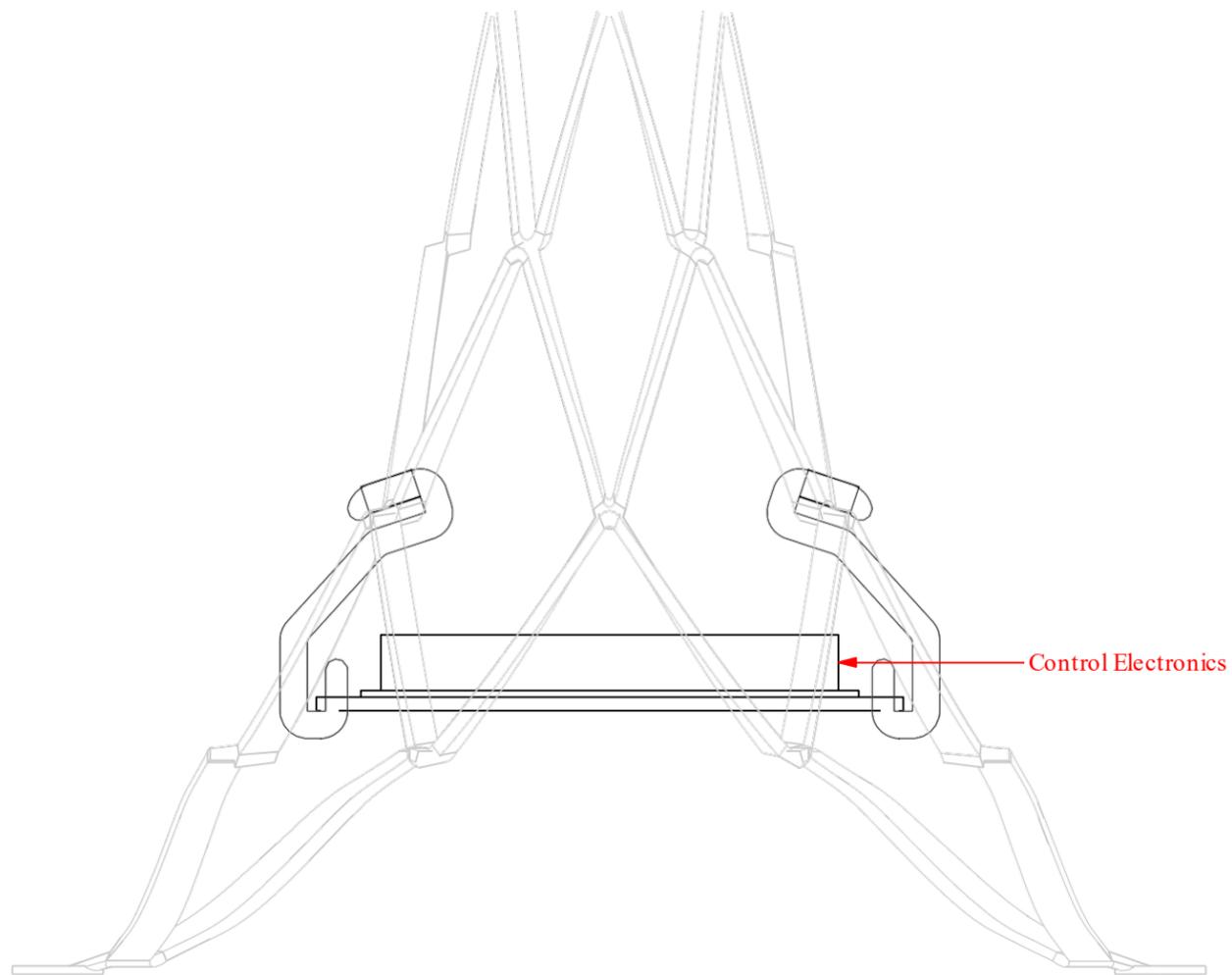
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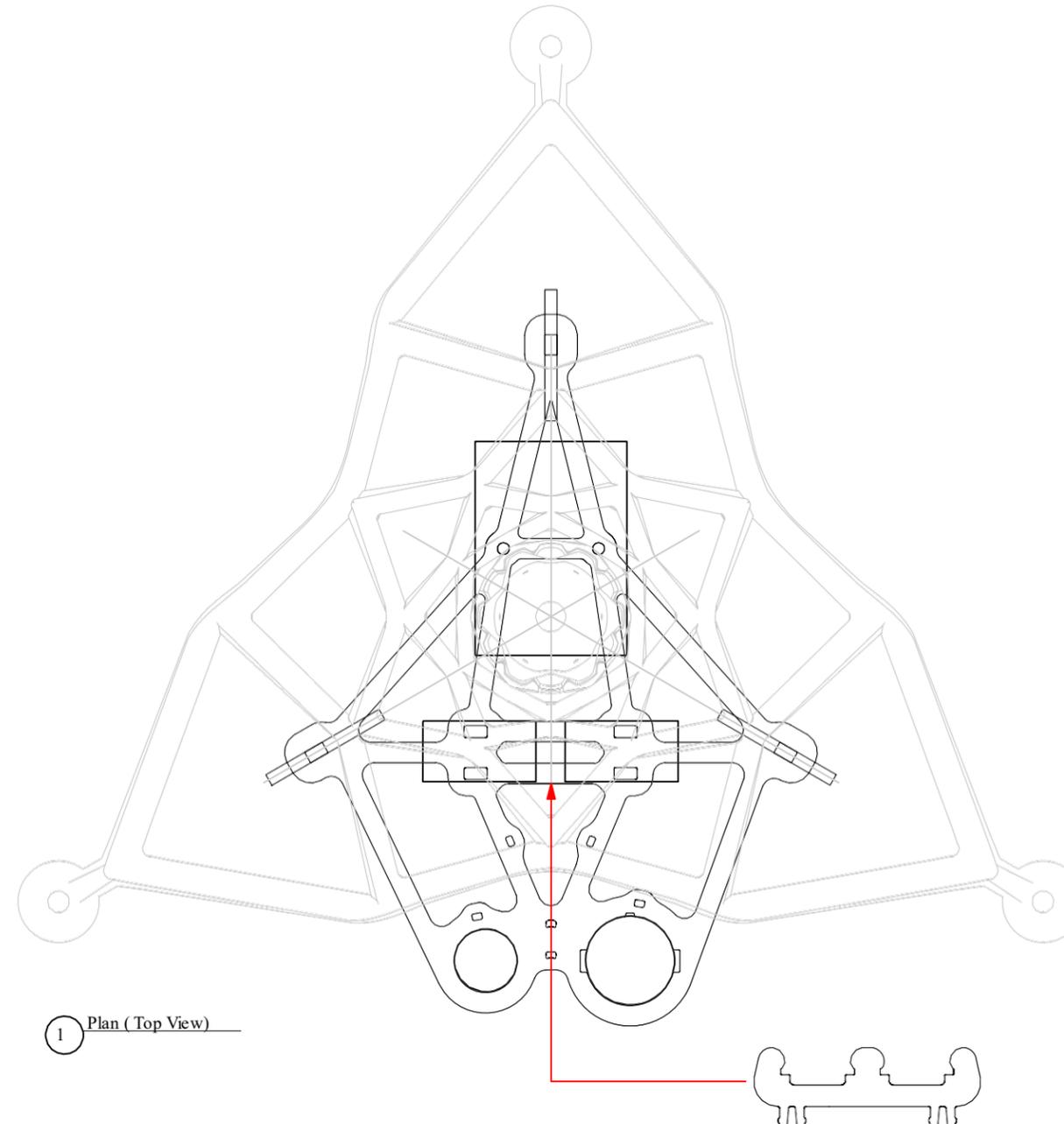
Drawing Title
Electronic Mount
Detail
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3



1 Elevation (Front View)



1 Plan (Top View)

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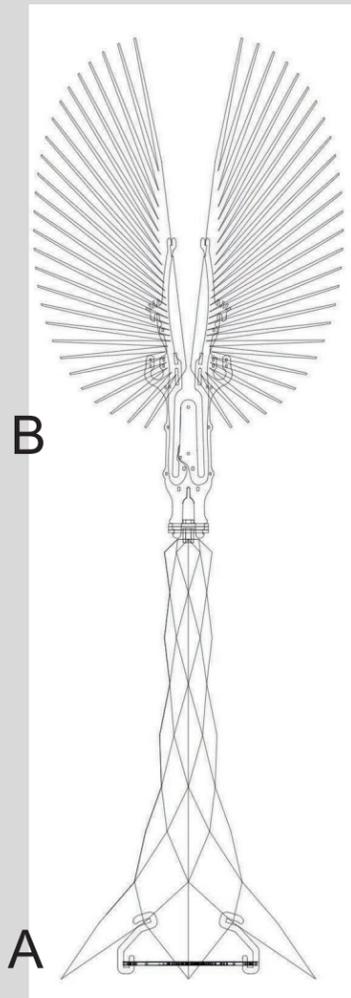
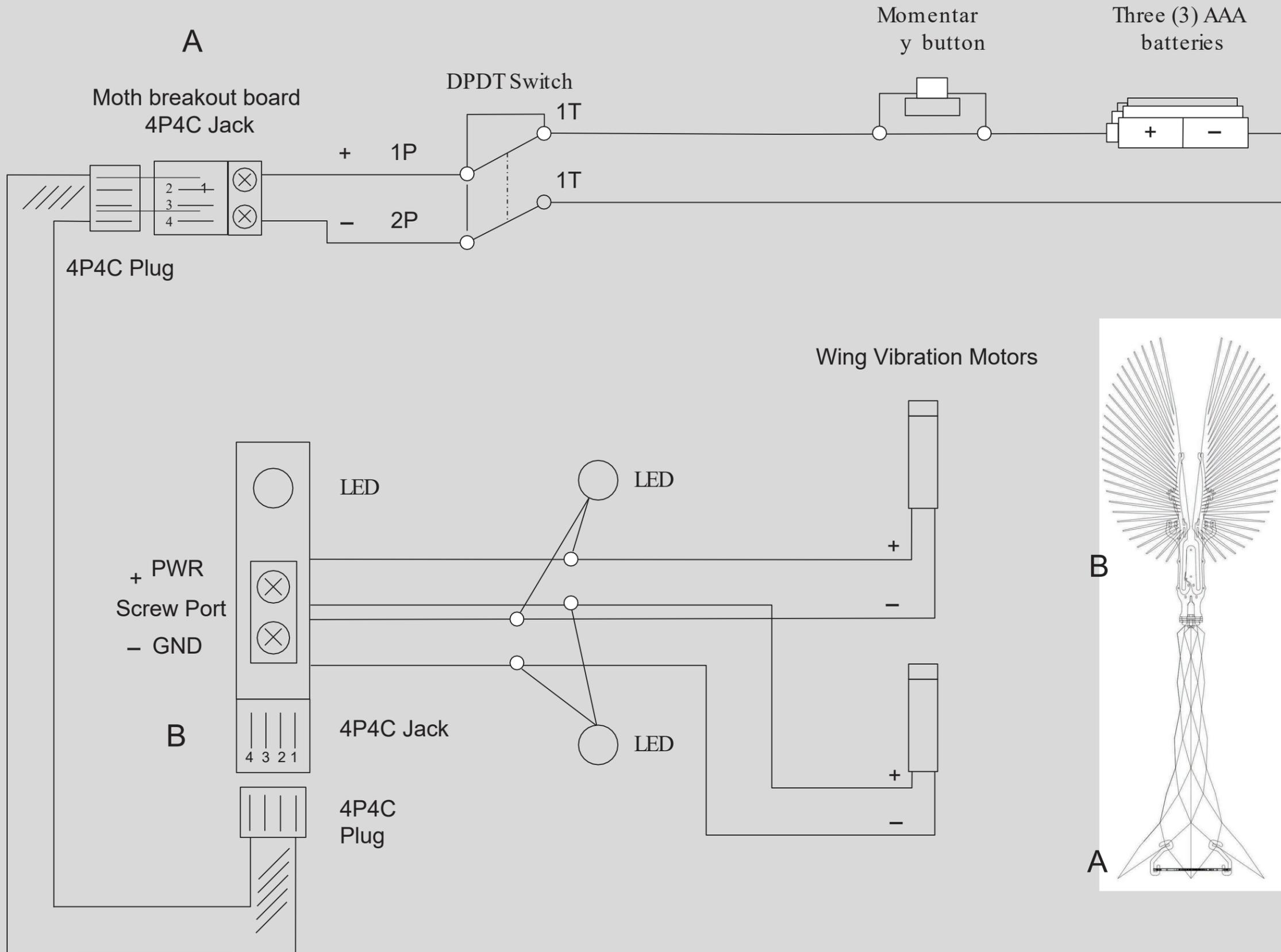
Legend

Phase
 Design Development

Project
Amatria
Moth
 Drawing Title
 Electronics Wiring Diagram

Drawing Scale

Sheet
A204



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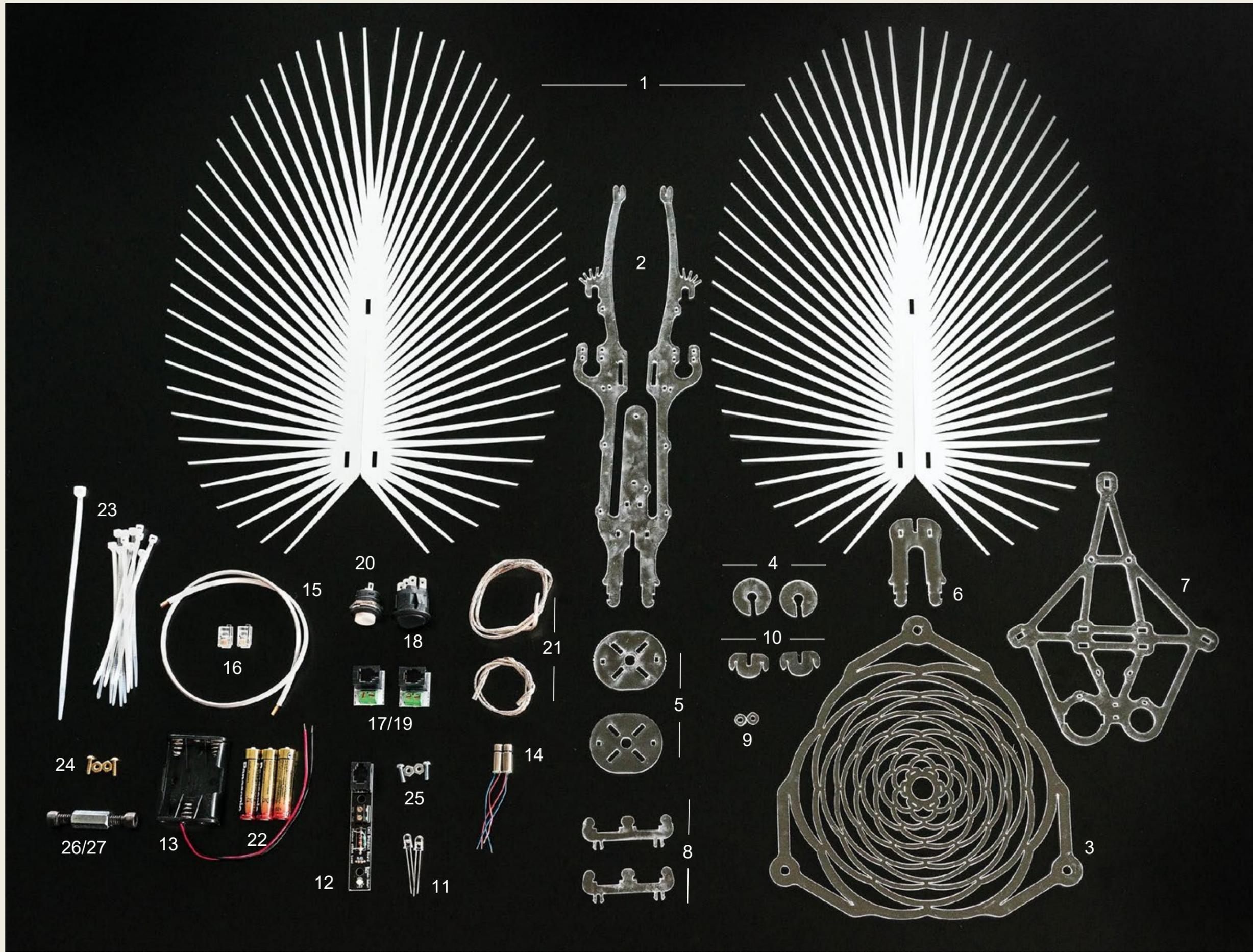
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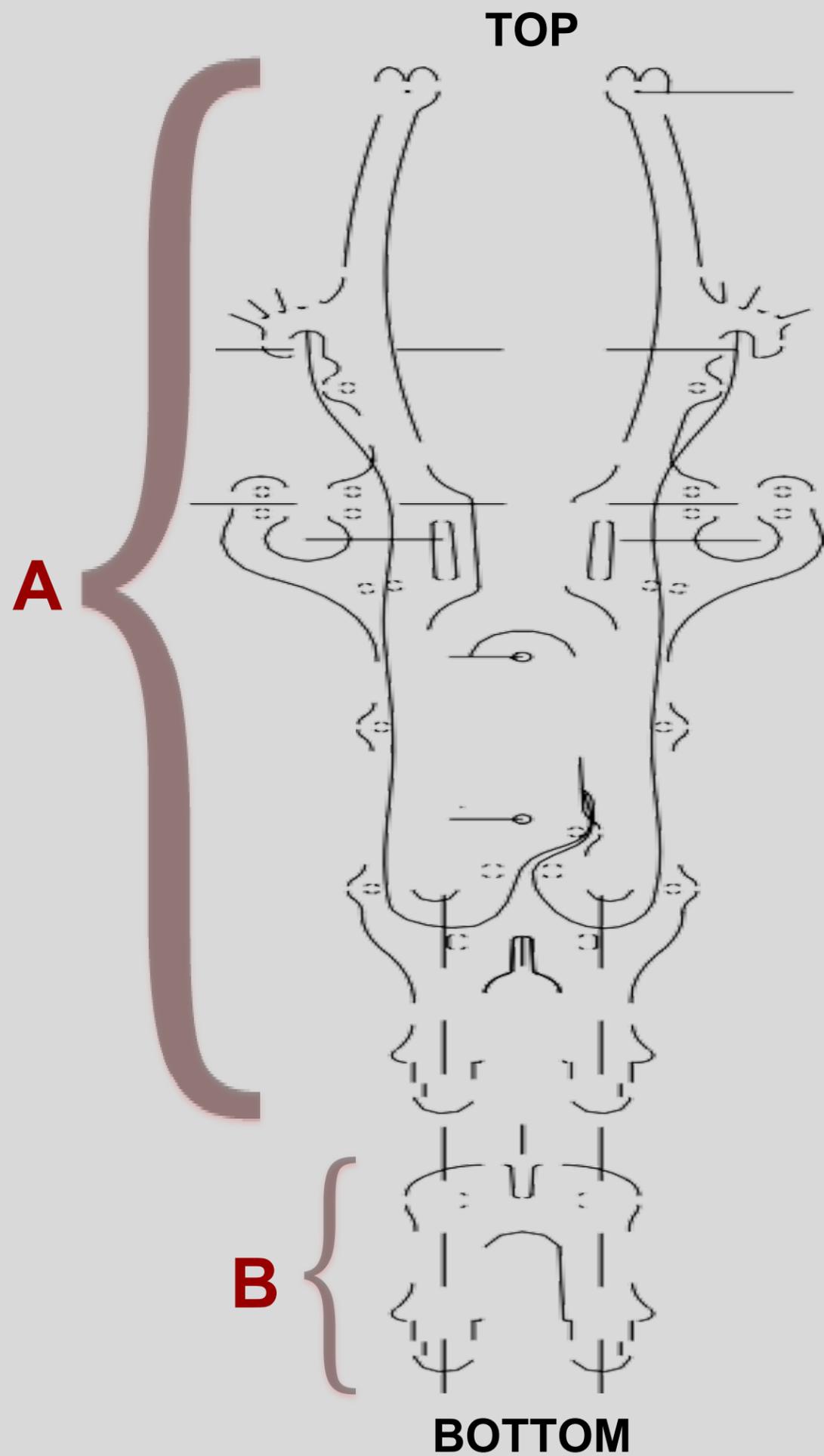
Notes

Legend

1. Frond (2)
2. Moth sled (1)
3. Spar (1)
4. Moth sled fastening (2)
5. Moth sled fastening plate (2)
6. Moth sled holder (1)
7. Electronics sled (1)
8. Electronics sled fastener (2)
9. Acrylic washer (2)
10. Frond fastener (2)
11. LED lightbulb (2)
12. Jack plate (1)
13. Battery pack (1)
14. DC motor (2)
15. Flat 4P short cable (47cm) (1)
16. Modular plug end (2)
17. Moth breakout board (2)
18. DPDT switch (2)
19. 4P4C jack (2)
20. Momentary button (1)
21. 24AWG speaker wire (2)
22. AAA battery (3)
23. Zip ties (12 sm, 1 lg)
24. Screw & washers for battery pack (2 ea)
25. Screw & washer for moth sled (2 ea)
26. Large plastic screw (2)
27. Metal sleeve for large plastic screw (1)

Project
Amatria
 Moth
 Title
Amatria Moth
 Parts



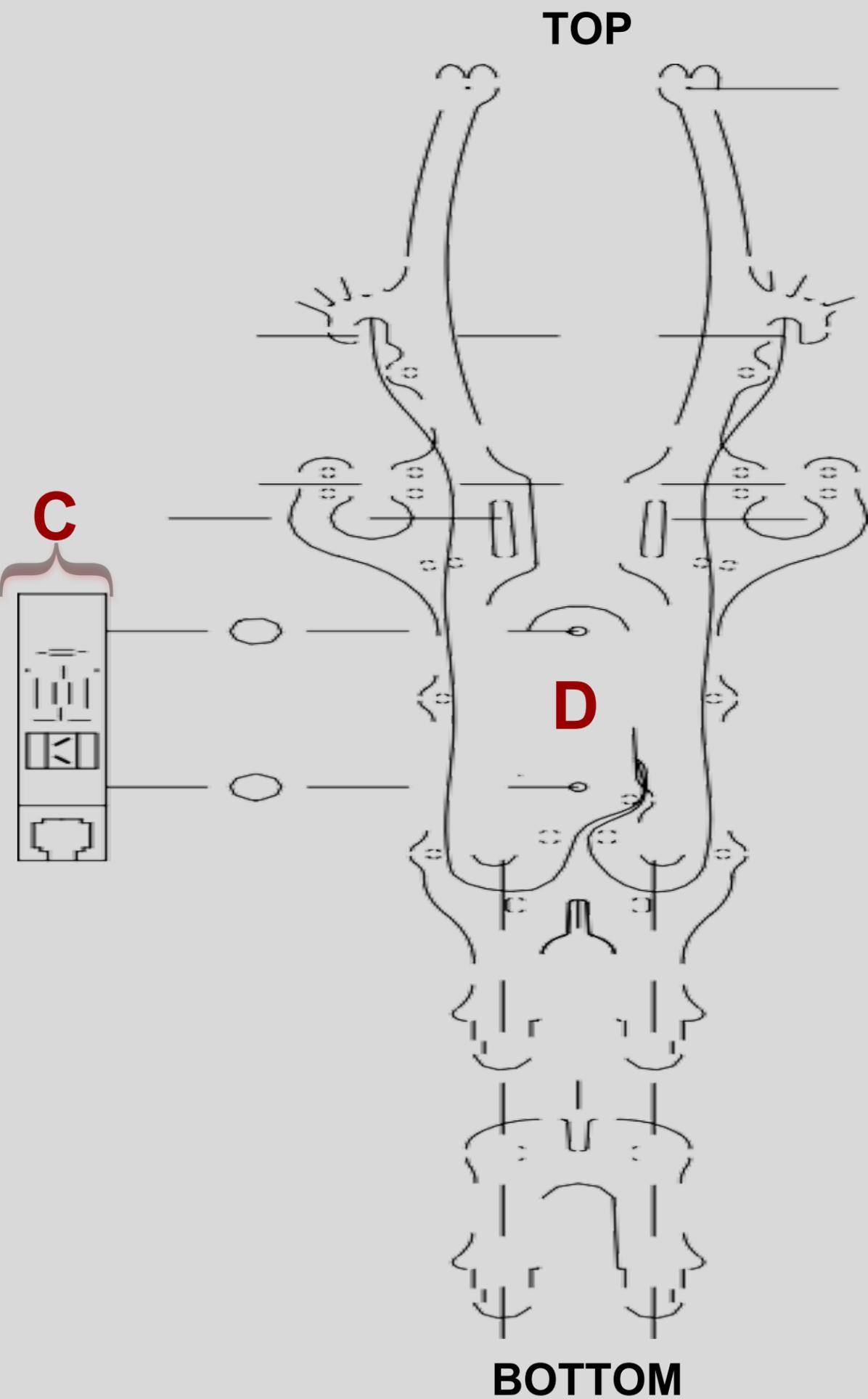


To construct the feather head of the Moth Sled

STEPS Page 1:

- 1) While holding the *Moth sled*(A) vertically, insert the *Moth sled holder*(B) into the bottom of the *Moth sled*, perpendicular to the bottom's prongs. With one *zip tie*, loop through the four holes to lock it in place.





STEP ~~Page~~ 2:

2) Align the *Jack Plate*(C) with the two holes at the center of the *Moth sled*(D), just above the bottom prongs.

- a) ****NOTE:** The black port component of the *Jack plate* should point towards the *Moth sled holder* (The *Jack plate* side will be considered the front of the *Moth sled*. All *zip tie* square locks should be facing the back).

3) Screw in the *Jack plate* loosely. Use the *washers* to lock it in place.



TOP

STEP 3: Page 3:

4) Moving from TOP to BOTTOM:

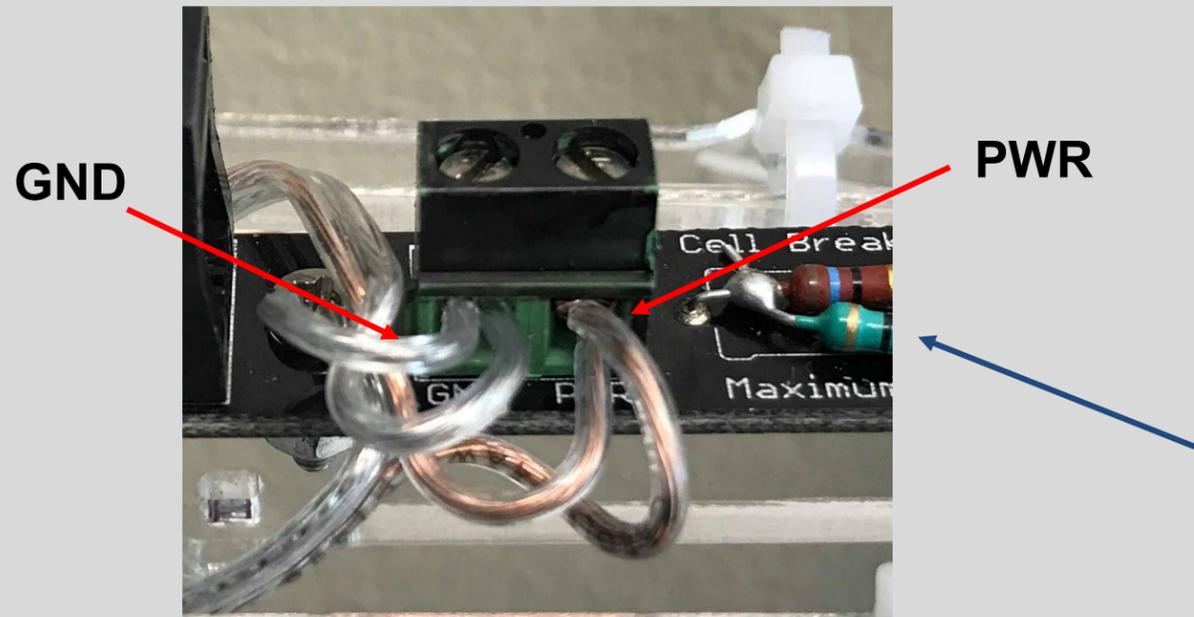
- Take one of the *LED light bulb* that has the *DC motor* attached, and fit the *LED light bulb* upwards into the first opening(). Secure the *LED light bulb* with a *zip tie* to the first hole().
- Once the *LED light bulb* is secure, insert the *DC motor* into the second opening() with the spinner facing down.
 - ****NOTE:** Make sure the spinner is not touching anything so that it can spin freely.

Using 2 *zip ties*, secure the *DC motor* within the 4 holes.

- Trail the *24AWG speaker wire* down the back side (opposite side of the *Jack plate*) of the *Moth sled* until it is past the next 3 holes. Using 3 *zip ties*, secure the *24AWG speaker wire*.

BOTTOM





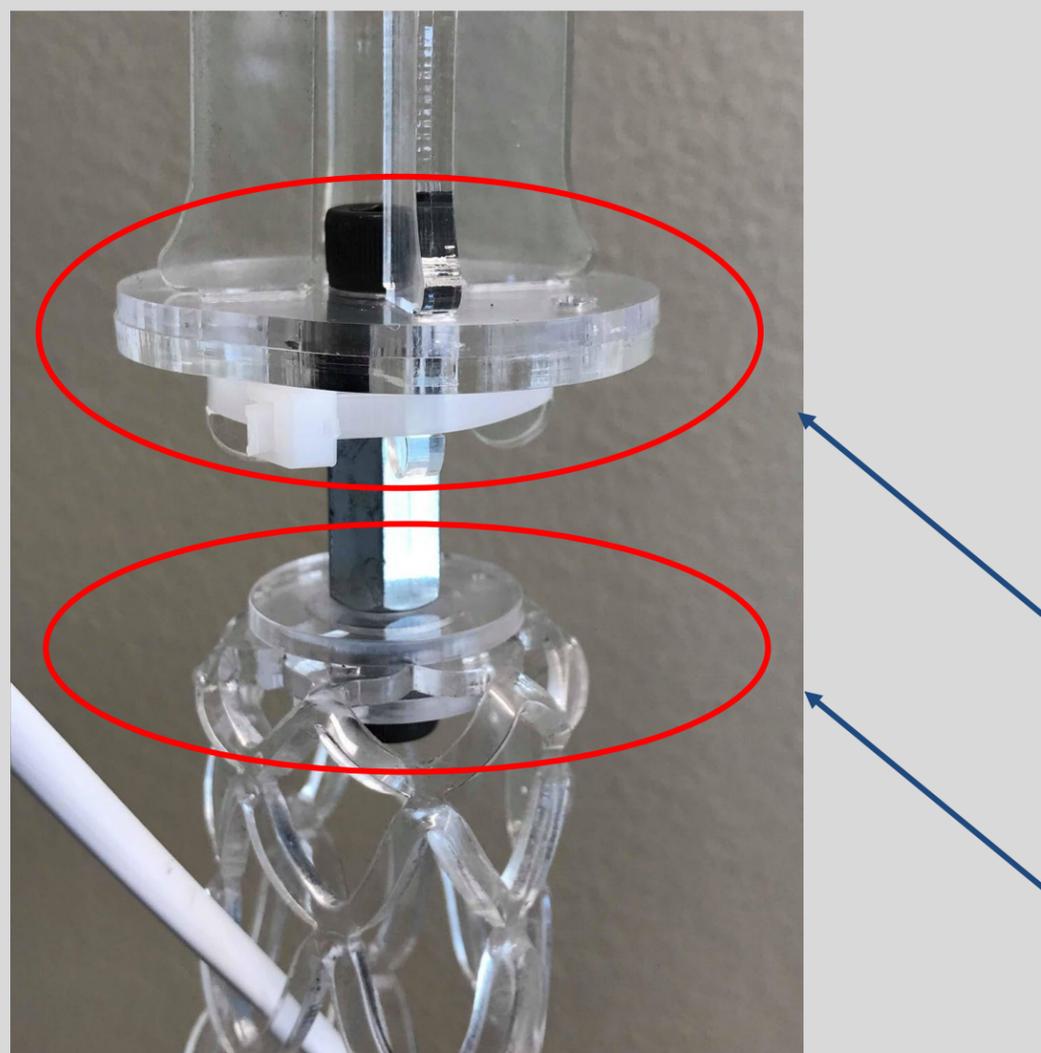
STEPPage 4:

5) Repeat all of step 4 for the opposite side of the *Moth sled* (LEFT or RIGHT) .

6) Above the large black port on the *jack plate* there is a small black and green port.

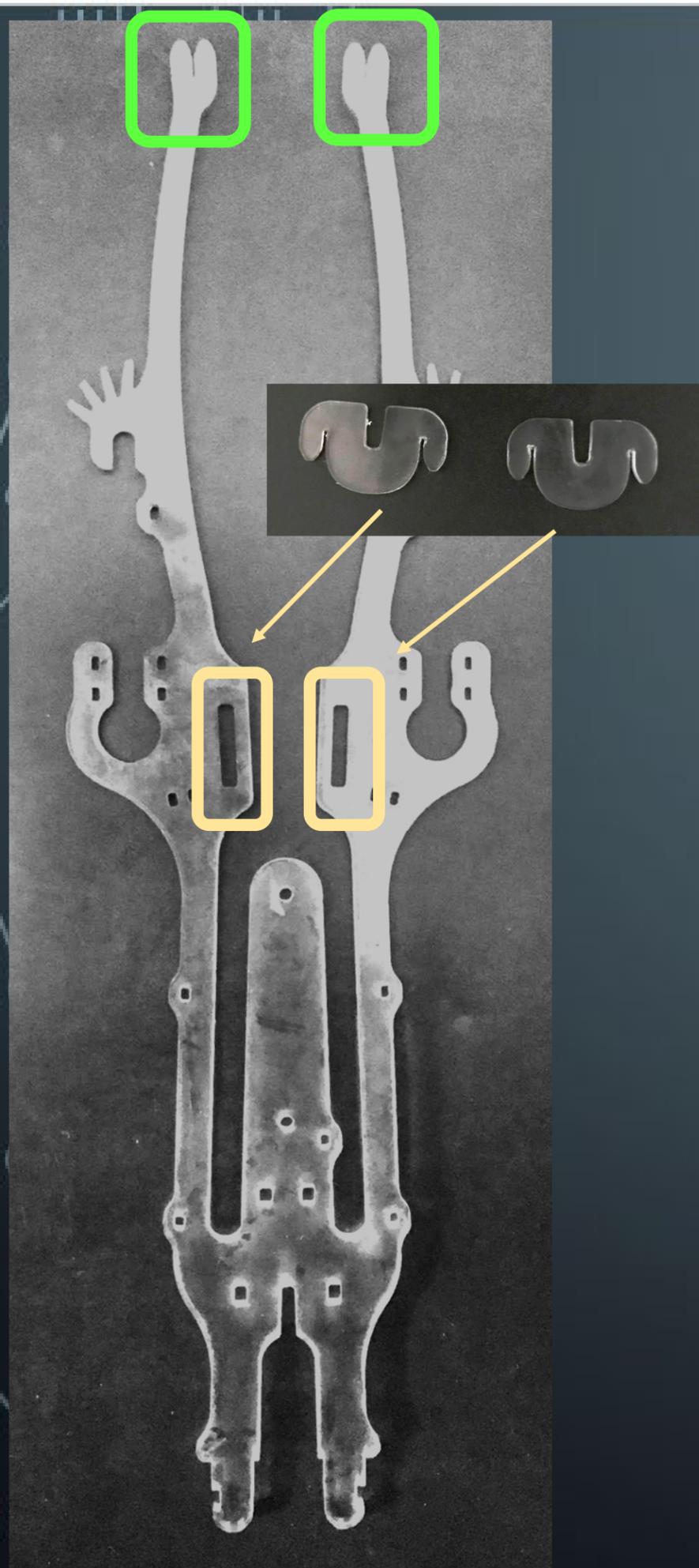
****NOTE:** Each *24AWG speaker wires* have a red copper wire side and a silver side.

- Twist together the red copper wire ends from each *24AWG speaker wire* (the same should be done for the silver wires).
 - Insert the red copper wires into the PWR square hole (right) of the black and green port. Holding the cord in place, tighten the screw above the PWR hole.
 - Insert the twisted silver wires into the GND square hole of the black and green port. Tighten the screw that is above the GND hole.



7) Place a *Moth sled fastener* on the top and bottom of the top end of the *Spar*. Secure it using 1 *Large plastic screw* and a *Metal sleeve*.

8) Insert a screw through 2 *Moth sled fastening plates*, and screw it into the *Metal Sleeve* to secure the *Moth sled* to the *Spar*.



STEP ~~5~~ page 5:

9) Insert the *Fron*d fastener into the slots in the yellow box in diagram on the left. The *fastener* will be pushed upwards when hooked with the *Fron*d.

10) Place the top slit of the *Fron*d onto the top slit of the tip of the *Moth sled* (green boxes).

11) Gently pull down the *Fron*d and connect the 2 bottom slits of the *Fron*d to the corresponding sides of the *Fron*d fastener. The *Fron*d has to be folded by the dotted line so that it opens up outwards (yellow boxes)

12) Repeat steps 9, 10 and 11 for the opposite side.

How to Construct the Light Bulb and DC Motor Component

Steps:

1. Grab the *DC motor* and strip the red and blue wire so that the plastic is gone and a small portion of the wires are visible.
2. Obtain one *LED light bulb*.
 - ** Note: The *LED light bulb* has longer and shorter prong.
1. Slide the *rubber tubing* down the red wire.
2. Carefully wrap the *DC motor's* red wire around the longer prong extension of the *LED light bulb*. Place a solder at the point of which you are trying to fuse them.
 - **NOTE: The *rubber tubing* should not be anywhere near the welder.
1. Place the heated welder at the fusing point and heat the solder until it begins to slightly melt.
2. Remove the solder and continue to use the welder to fuse the components while shifting them accordingly .
3. Shift the rubber tubing over the fused component and heat it with the heat gun on low for about 45 seconds.
4. Repeat steps 3-5 with the DC motors blue wire and the shorter metal extension of the LED light bulb.



Reference:

<https://cns.iu.edu/amatria.html>