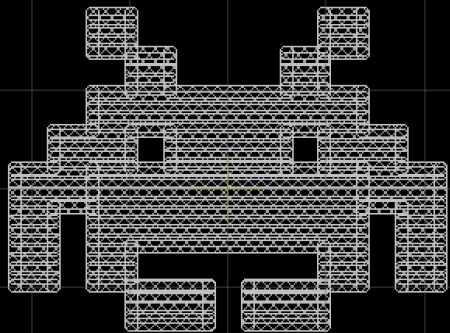# Boggling the Boardhouse

Designing 3D Structures, Circuits, and Sensors from PCBs

Nick "Reply Bi" Poole
@NorthAllenPoole

Very Powerful Wizard | Engineer for
@sparkfun | 🏳️‍🌈Bi | pronoun.is/he |
⌜ Personal Account ⌟| Cyberpunks say
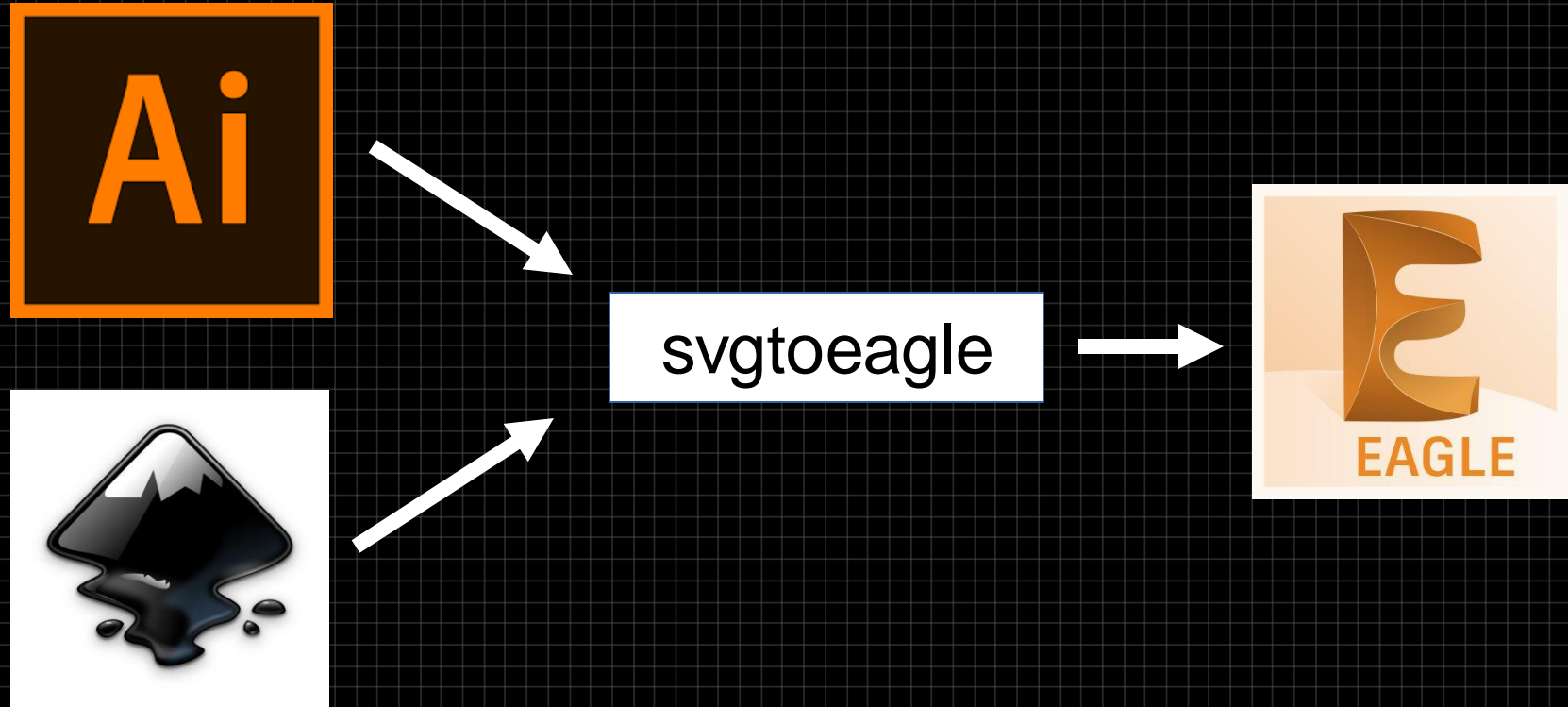Trans Rights | 📻KE0MKA

The Basics:
Bringing Weird Shapes into EDA

Bringing Weird Shapes into EDA
3 Ways

1. svgtoeagle (for people with vectors)

2. Buzzard (for people with bitmaps)
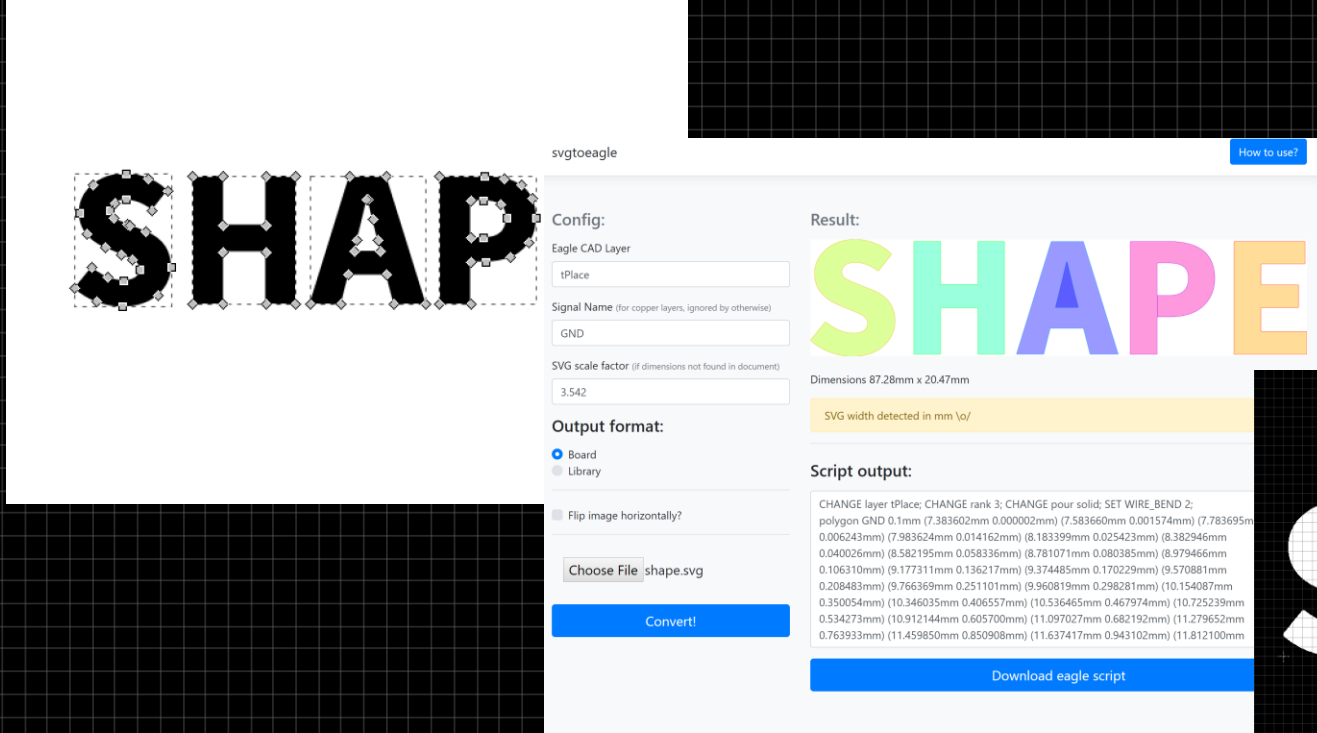
3. Just draw it in your EDA (for masochists)

Bringing Weird Shapes into EDA
Method 1: "svgtoeagle" by Gordon Williams

Bringing Weird Shapes into EDA
Method 1: "svgtoeagle" by Gordon Williams

Bringing Weird Shapes into EDA
Method 1: "svgtoeagle" by Gordon Williams

Bringing Vector Artwork into Autodesk Eagle

The Accumulator • 851 views • 11 months ago

Import sophisticated vector artwork from Adobe Illustrator into Autodesk **Eagle** and use it on your PCBs without rasterizing! Enjoy!

21:25

Bringing Weird Shapes into EDA
Method 1: "svgtoeagle" by Gordon Williams

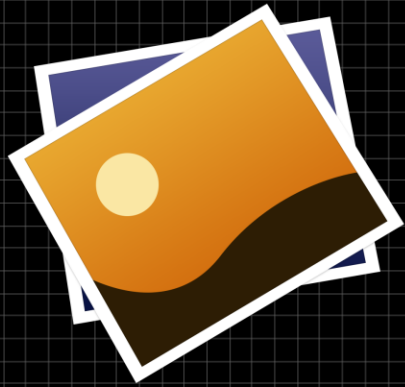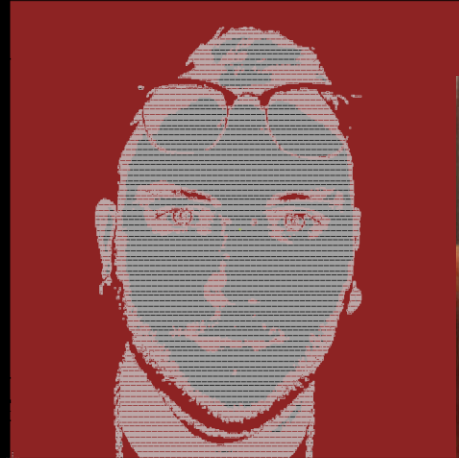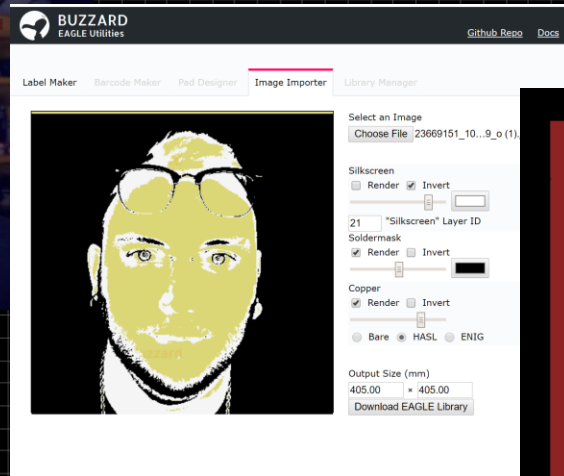| Advantages	Disadvantages
Small file sizes	Image must be a vector drawing
Accurate dimensions	Some pre-processing is required
Create filled polygons / pours	Moving imported items is a pain (unless you create a footprint)

Bringing Weird Shapes into EDA
Method 2: Buzzard Image Importer

Bringing Weird Shapes into EDA
Method 2: Buzzard Image Importer

Bringing Weird Shapes into EDA
Method 2: Buzzard Image Importer

Advantages

Basically any image format

Preview and generate
Silk, mask, and copper
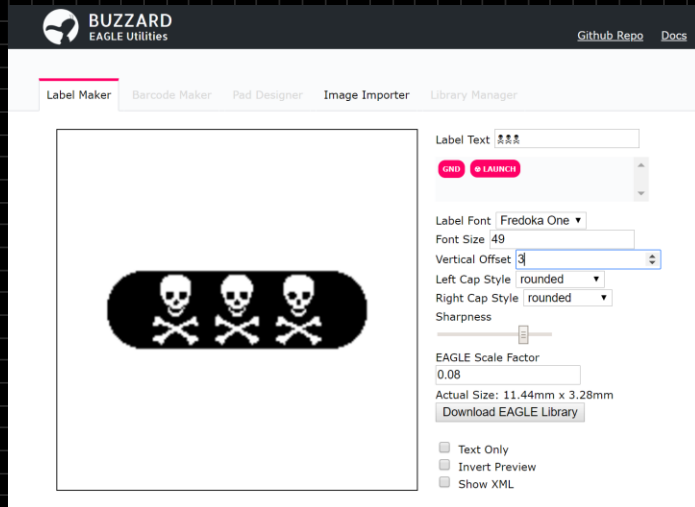Layers together

Exports library footprint

Disadvantages

Very large file sizes
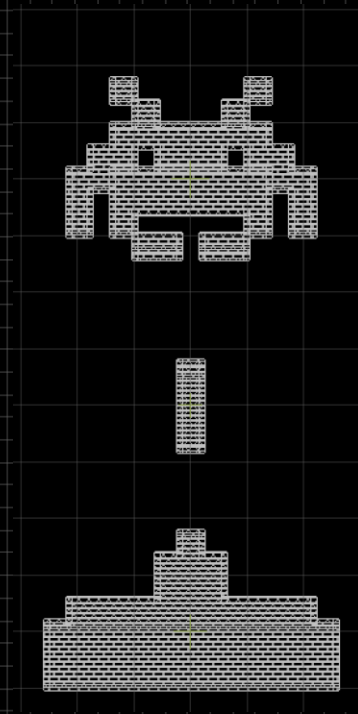
Long CAM processing times

Fixed import resolution

Bringing Weird Shapes into EDA
Method 2b: Buzzard Label Maker

Bringing Weird Shapes into EDA
Method 3: Just Draw it in your EDA

Bringing Weird Shapes into EDA
Method 3: Just Draw it in your EDA

Advantages

Works in any EDA

No external tools

Great for pixel art
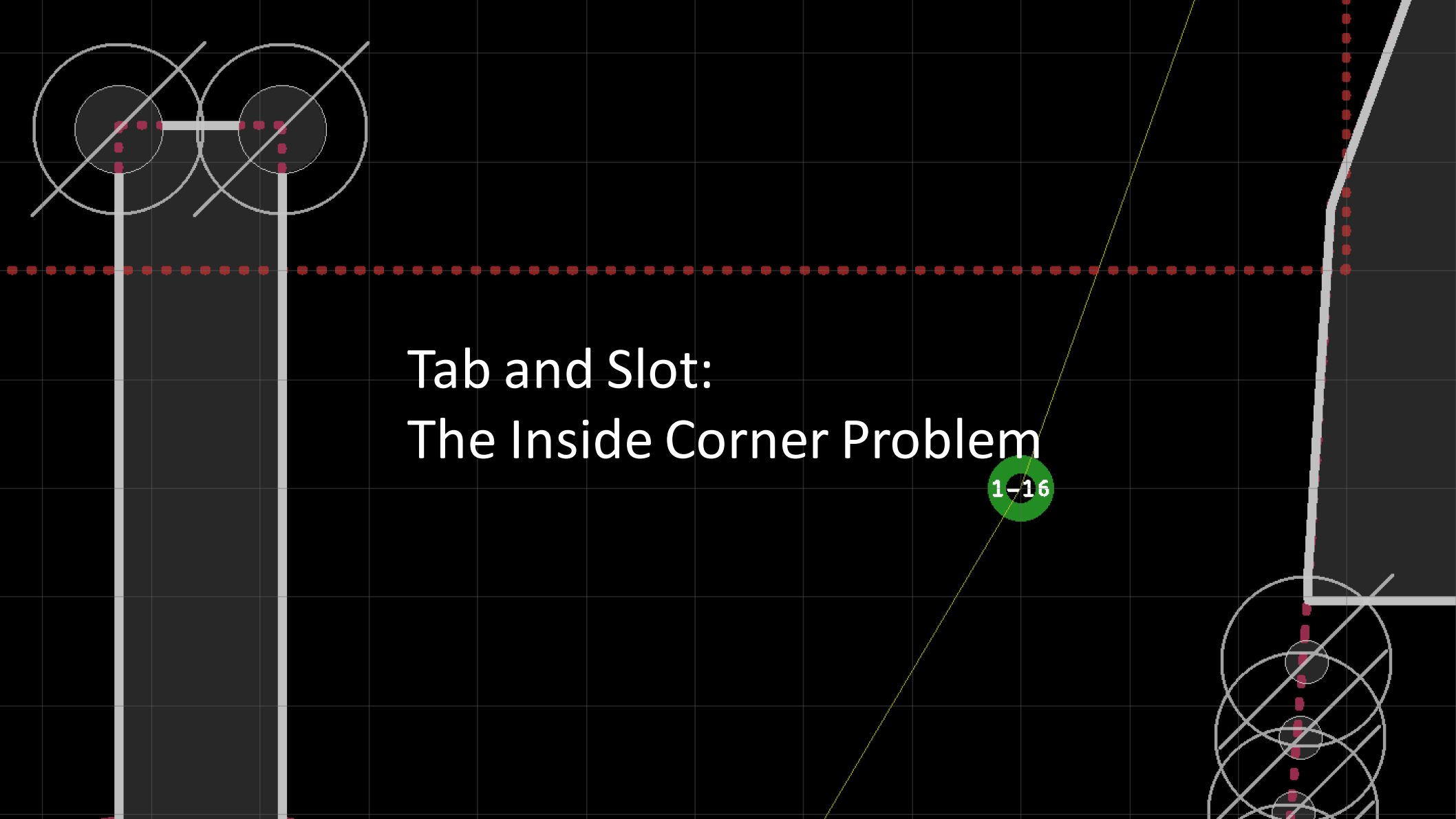
Disadvantages
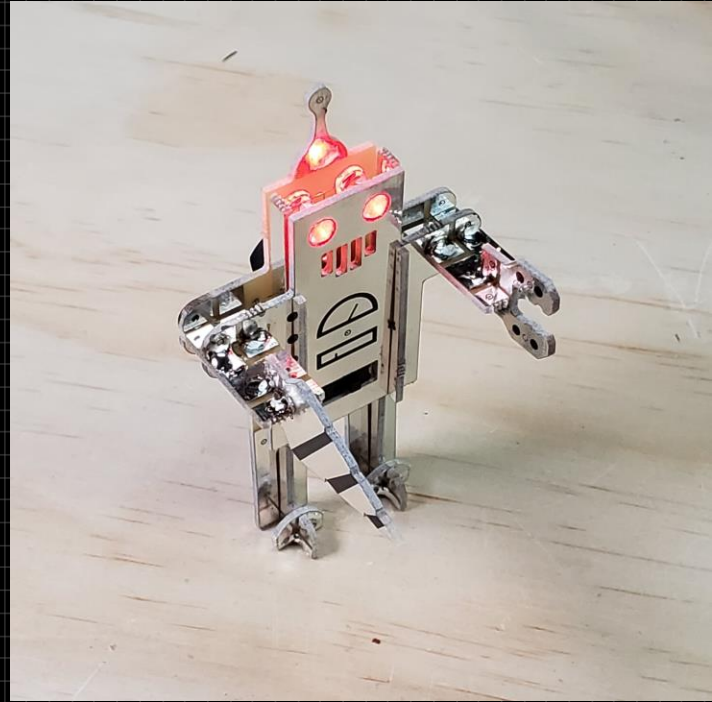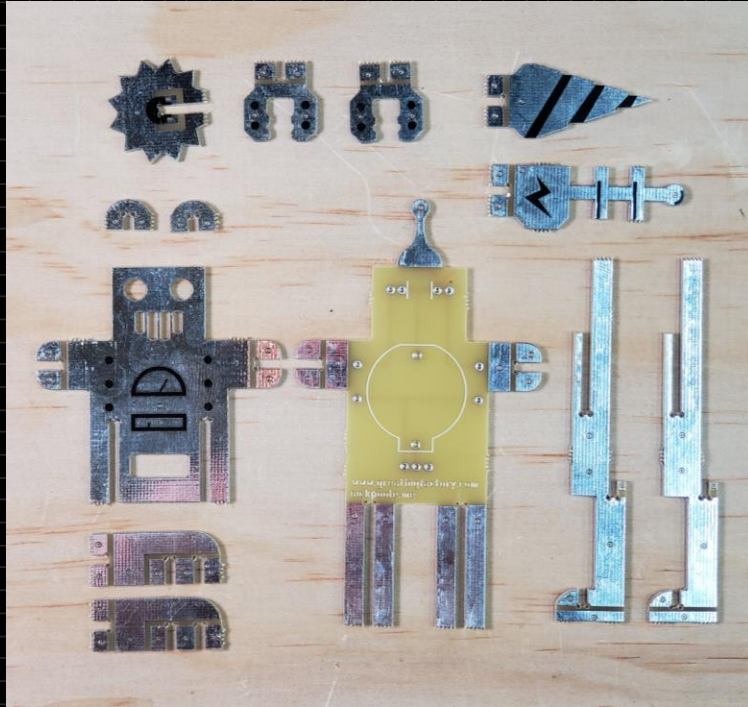
EDA tools are bad for drawing

You have to draw a thing

Tab and Slot:
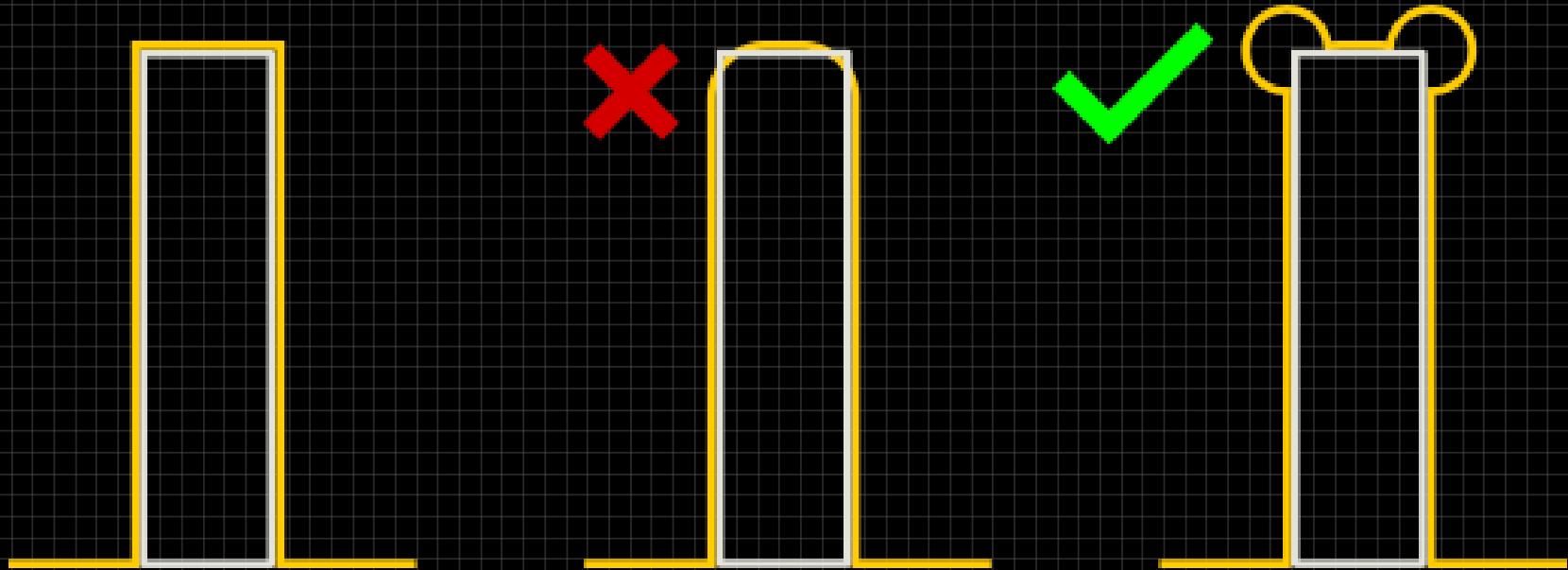The Inside Corner Problem

1–16

The Inside Corner Problem
What's the problem?
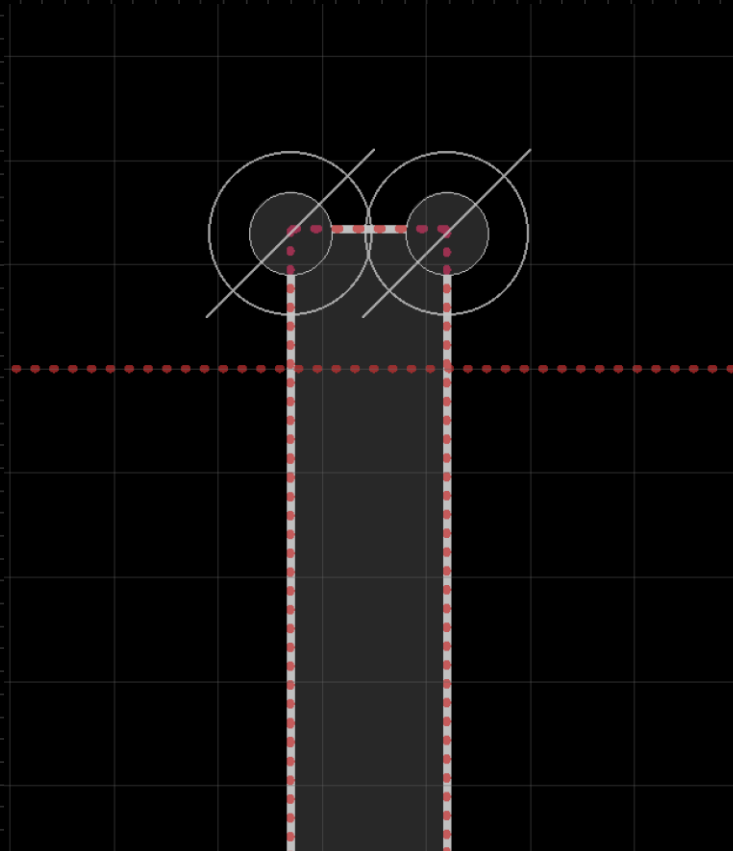
The Inside Corner Problem
What's the problem?

The Inside Corner Problem
How Do We Solve It? Corner Relief!

Fillet Soldering:
How to Avoid Lifting Pads

Fillet Soldering
What's a Fillet?

- Not a "fil-ay"
- Rounded corner
- Joins two surfaces
  at an angle

Step 1: Wet the tip of the iron with solder
It helps to have a little solder on the tip of your iron to transfer heat to the pad

Step 2: Add solder to one side of the fillet
Apply the iron to one side of the fillet and start feeding solder in until you have a good puddle

Step 3: Drag solder to the other side
Drag the tip of the soldering iron into the corner between the pads and feed solder into the other side to form the fillet.
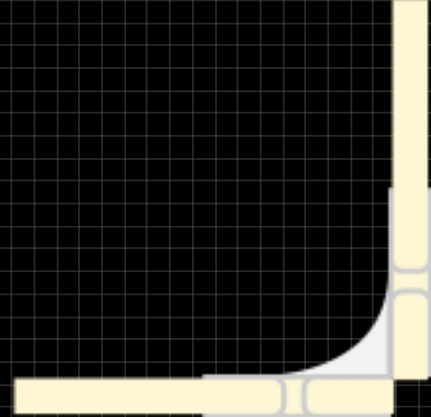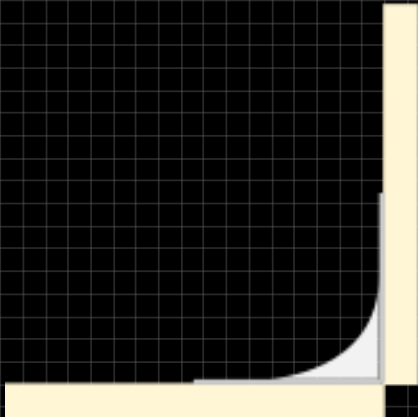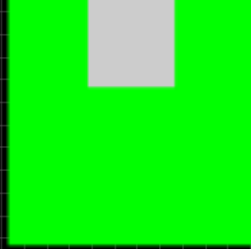
Step 4: Done!
If everything got hot enough, you should have a concave fillet of solder connecting the two pads!
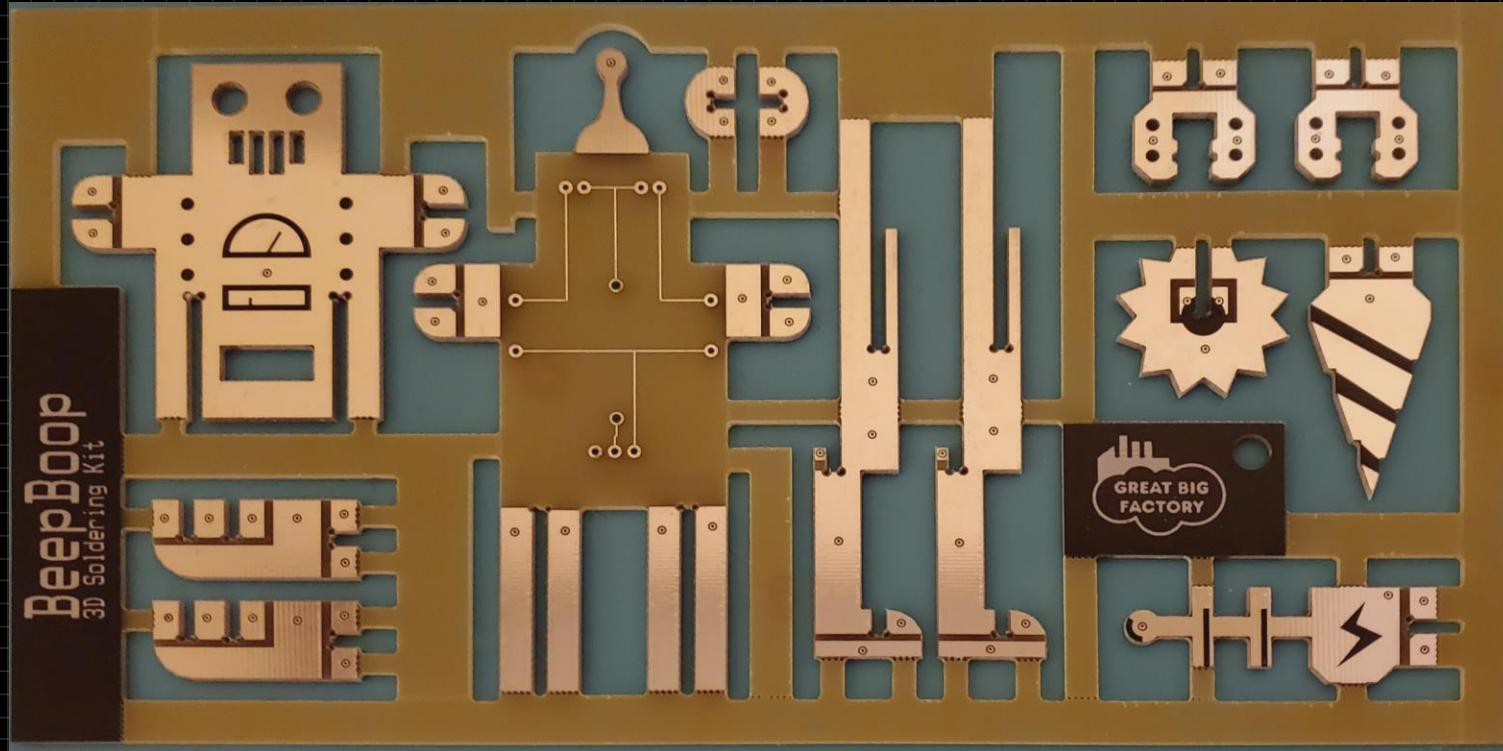
Fillet Soldering
Designing a Fillet Joint

Imitating Model Sprues
w/ Mouse Bites

Imitating Model Sprues
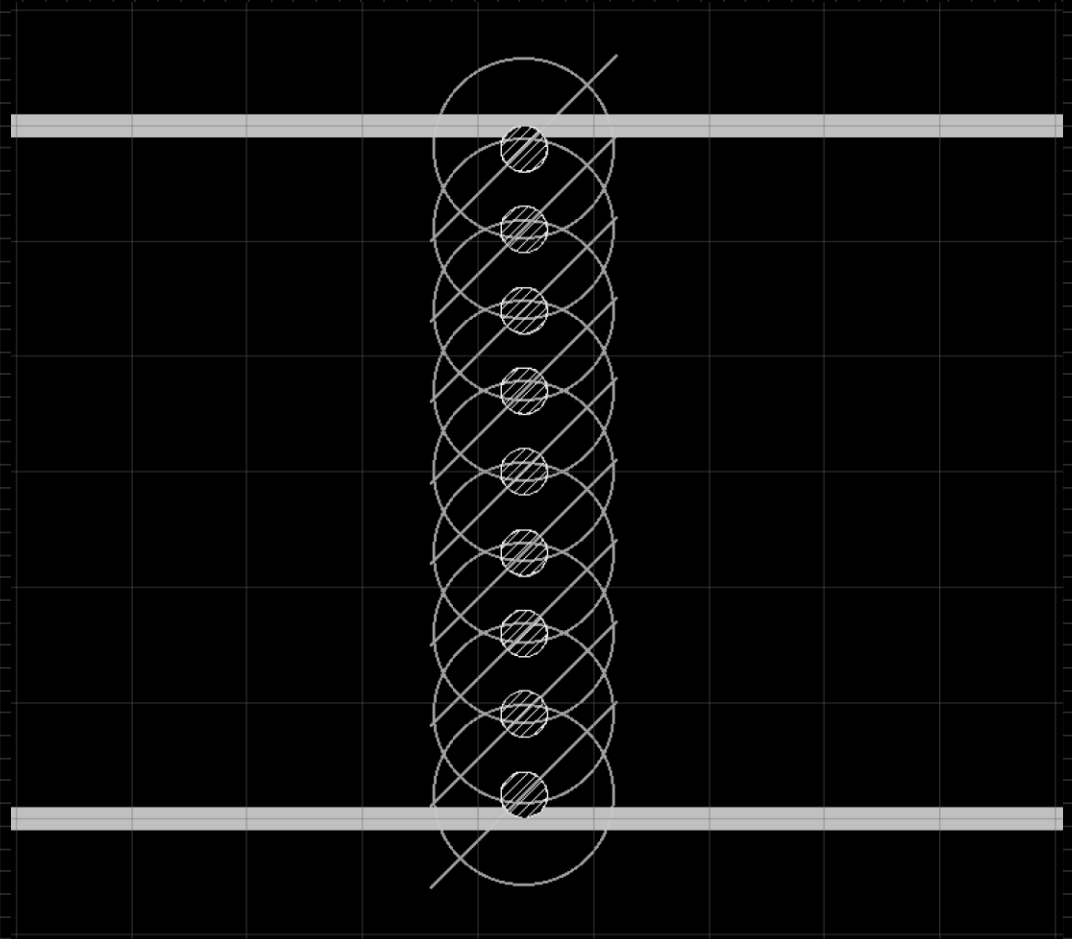# w/ Mouse Bites

Imitating Model Sprues
w/ Mouse Bites

Imitating Model Sprues w/ Mouse Bites

- Diameter
  0.02" (20mil/0.5mm)
- Spacing between centers
  0.04" (40mil/1mm)
- Snaps easily by hand at
  0.8mm thickness
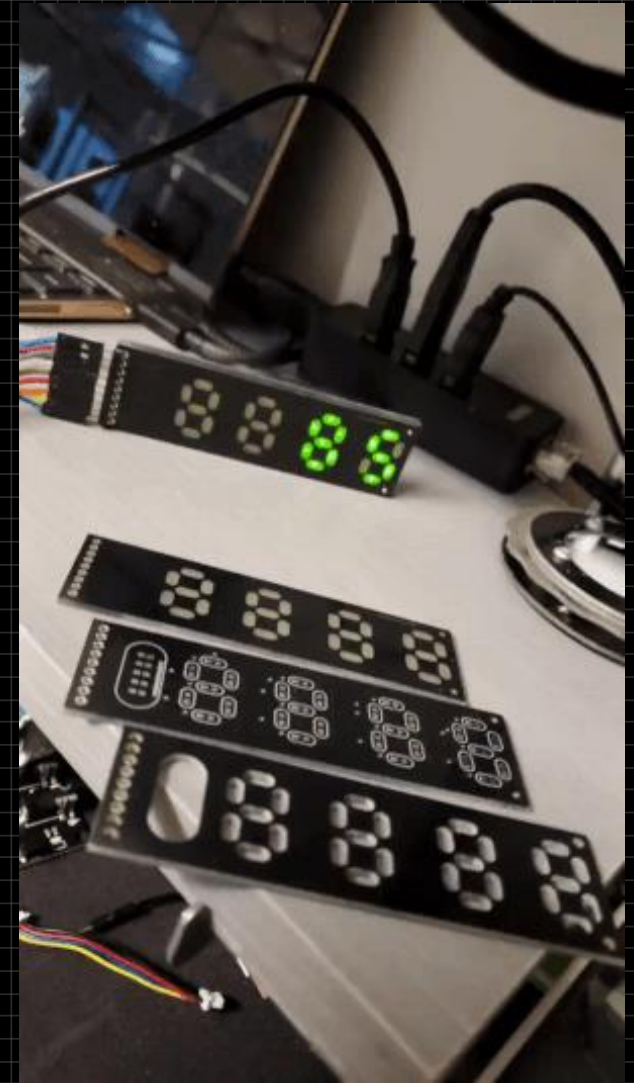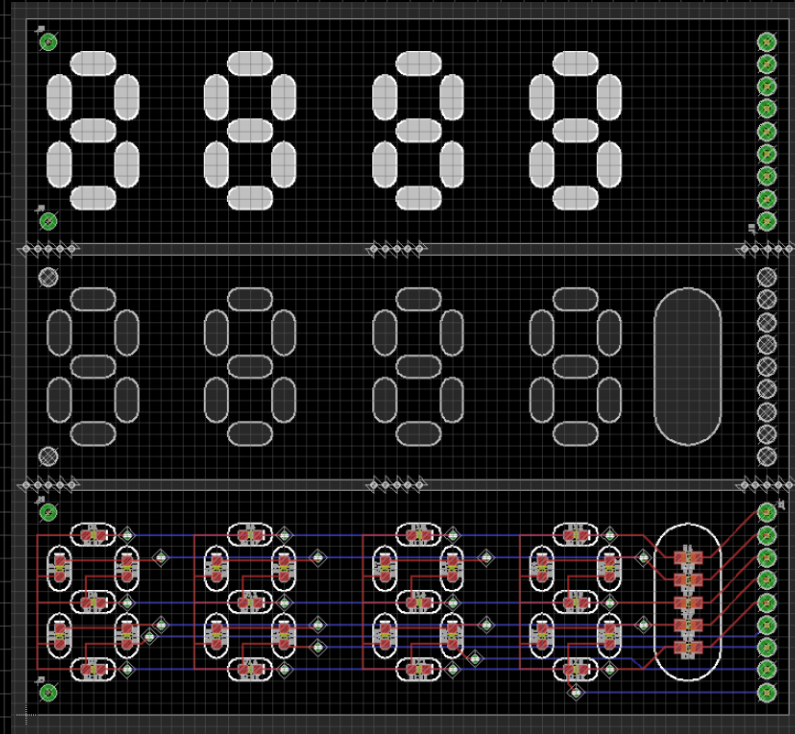- Pliers help at 1.6mm

Imitating Model Sprues
w/ Mouse Bites

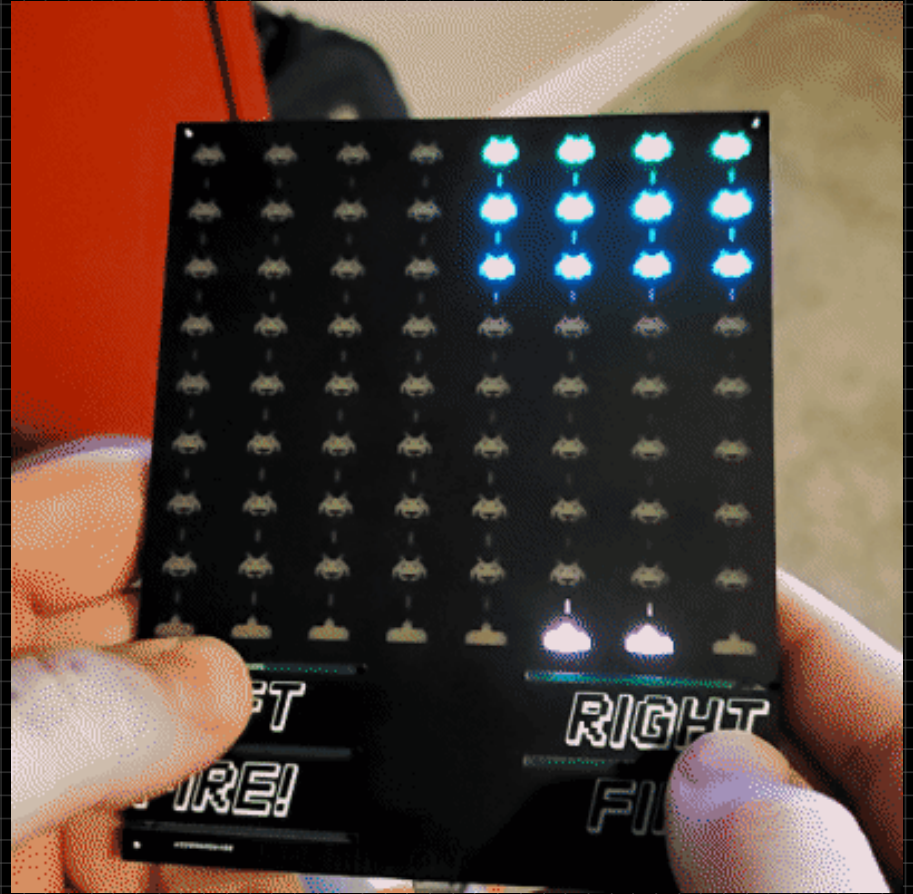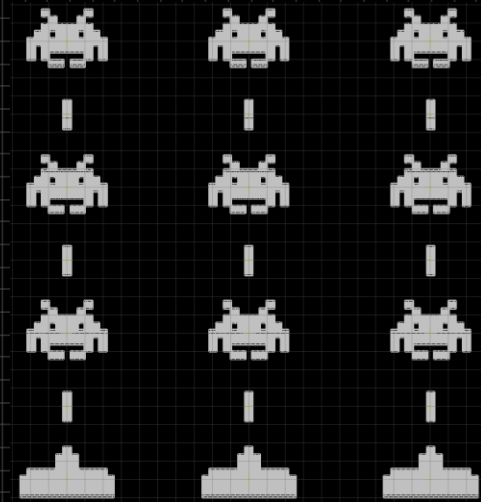Manipulating the Mask
Layer for Custom Displays

Manipulating the Mask Layer: Custom Displays

- Fiberglass is translucent!
- tStop & bStop layers
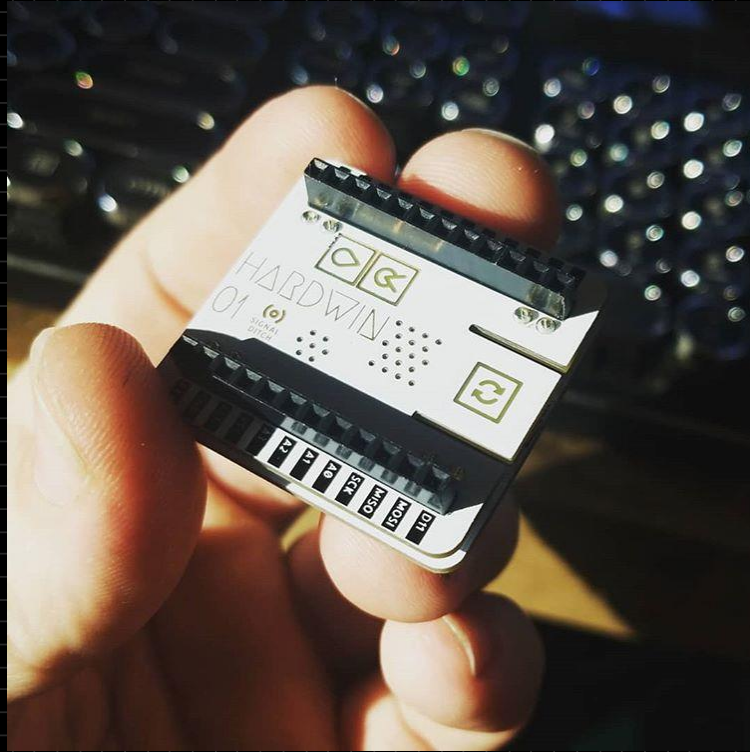- Make sure the copper layer is clear

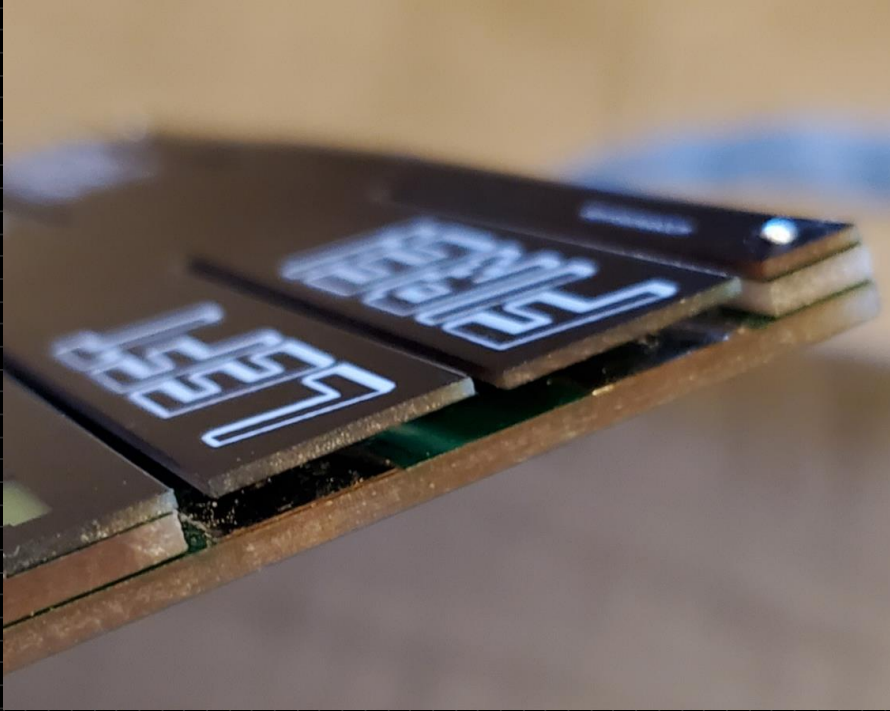# Manipulating the Mask Layer: Custom Displays

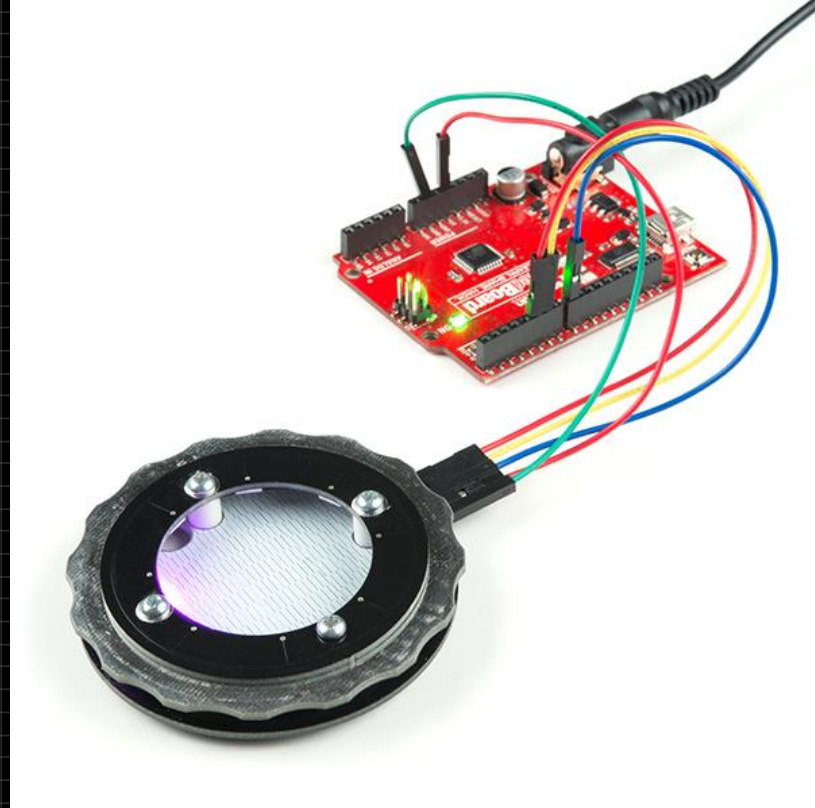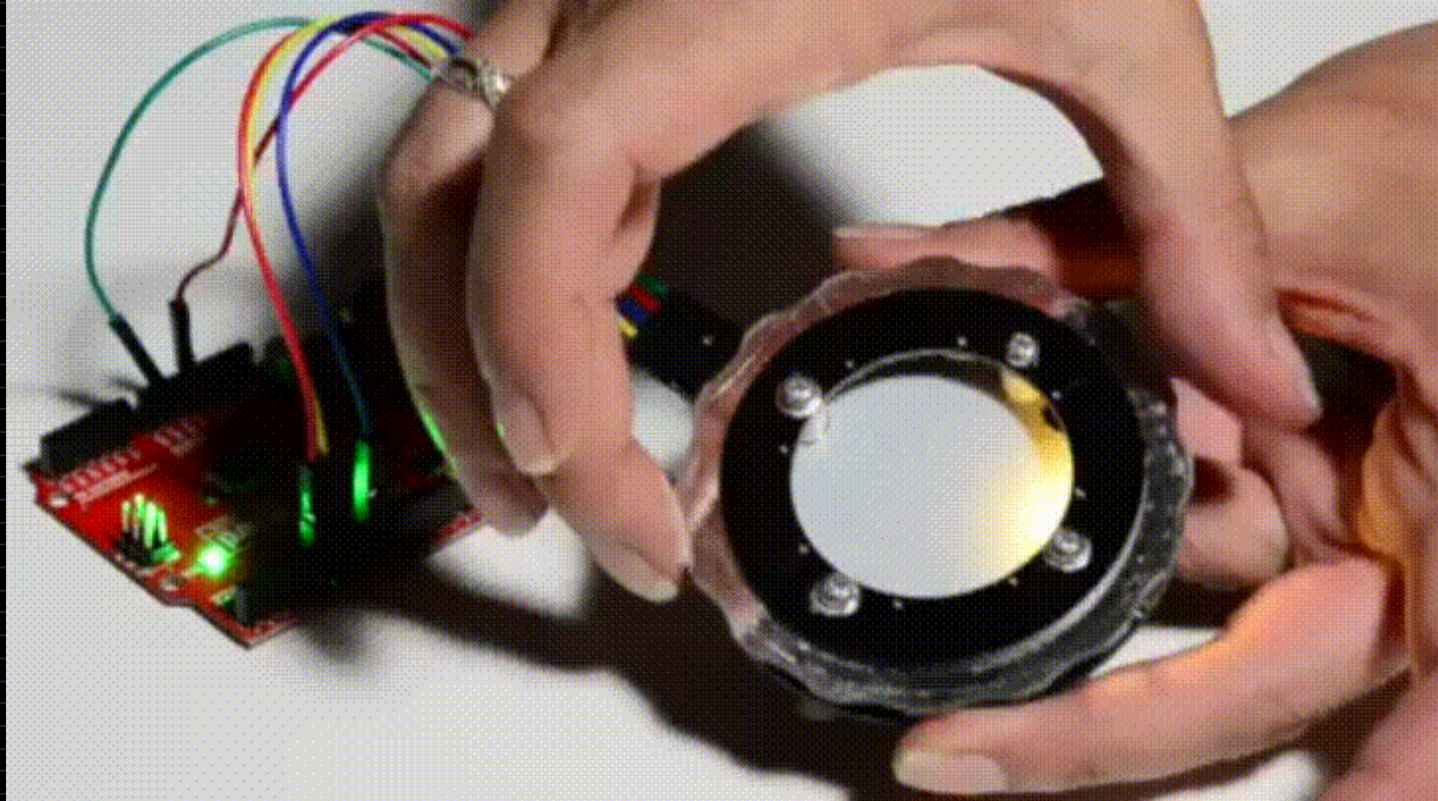Bendy Tab Buttons

Bendy Tab Buttons

Bendy Tab Buttons

Wipers and Contacts:
A Working Rotary Encoder

Wipers and Contacts:
A Working Rotary Encoder
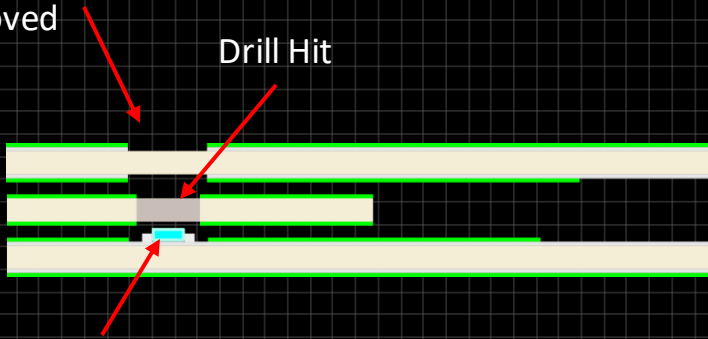
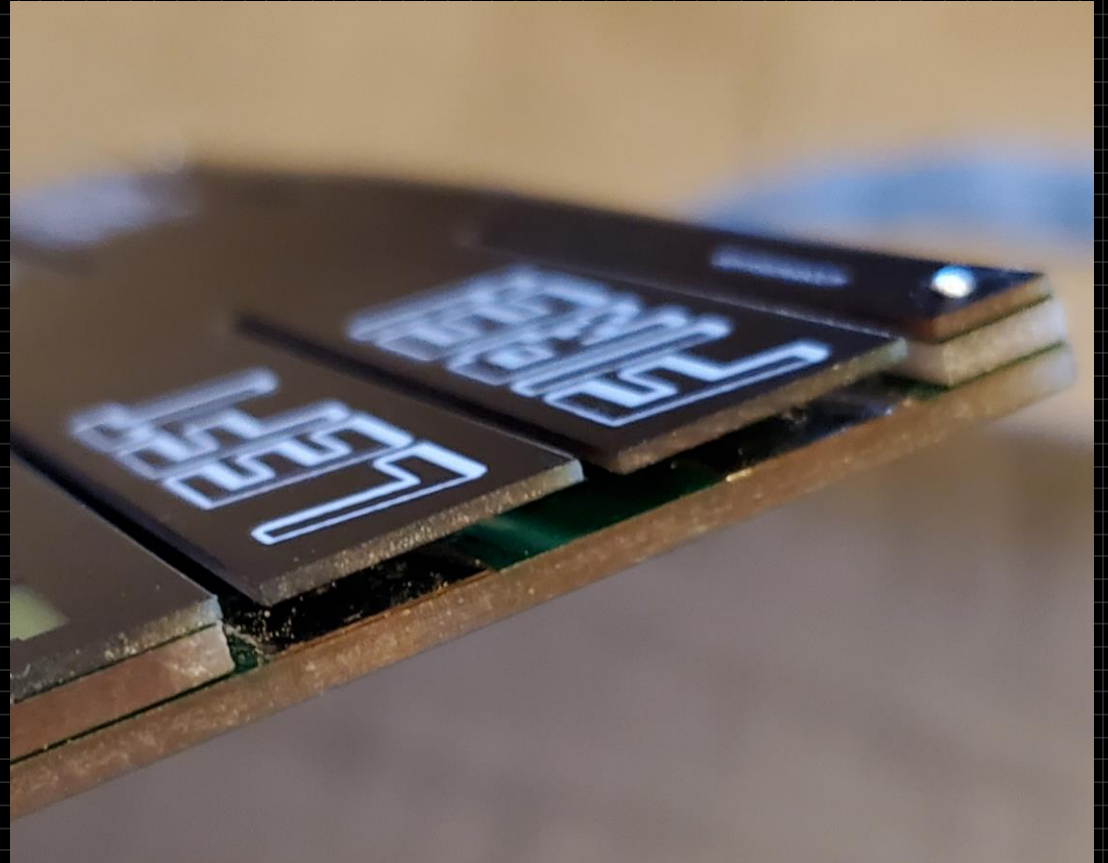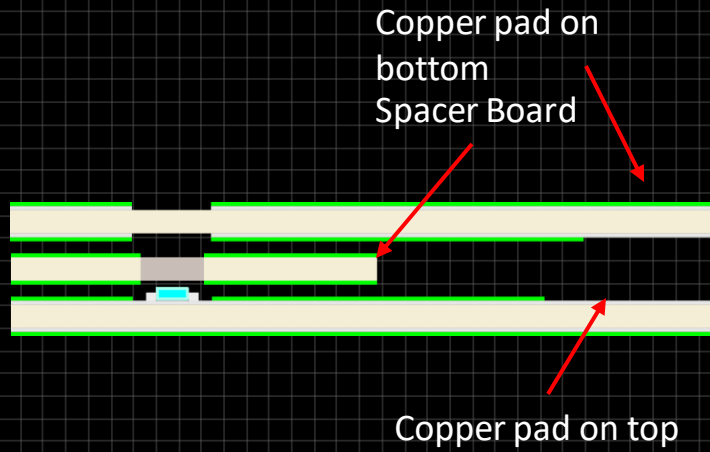# Wipers and Contacts:
A Working Rotary Encoder

Stacking Boards

Stacking Boards

Mask & Copper Removed

Drill Hit

LED

Stacking Boards

Copper pad on bottom Spacer Board

Copper pad on top

Leaving Clues for the Production Engineer

- Check up on your fabhouse's capabilities (drill sizes, min spacing, min slot width, etc)
- Leave notes (in a layer that makes it to gerbers)
- Label "mill out" or "route out" shapes
- Label v-score lines
- Don't order silk if there's no silk
- If two pours don't connect, make it clear that they're not supposed to

Thank You!

Slides, Example Projects and Links to Resources

https://github.com/NPoole/Boggling_the_Boardhouse