B09 OtherMill Use Guide v0.1

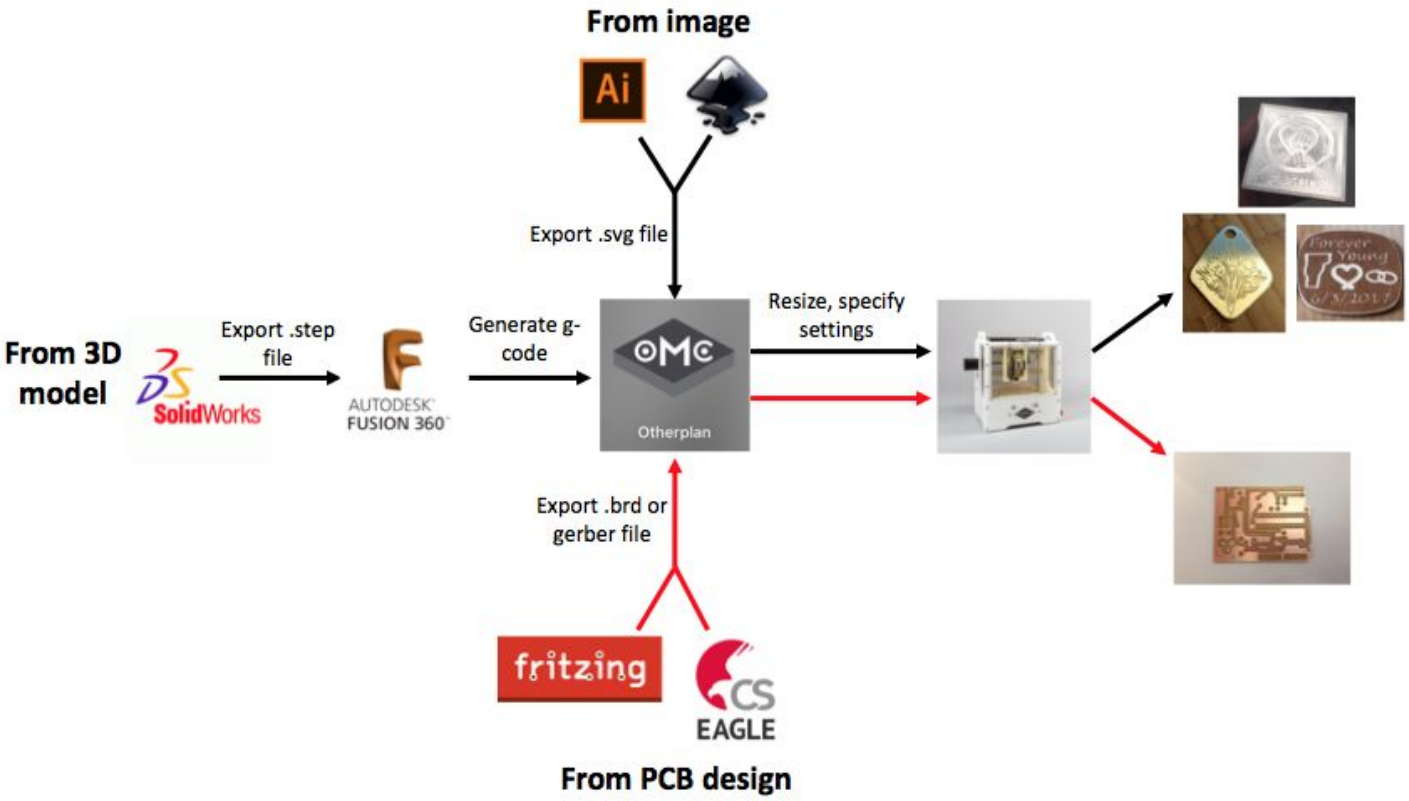
Tutorials, tables, and tips galore!

If you need help, contacts Adam or Mike:
Adam - (412) 215-7725, als299@pitt.edu
Mike - (412) 303-8722, mike.urich@pitt.edu

OtherPlan and OtherMill Manuals

DO NOT attempt to operate the OtherMill if not trained! Let us know at als299@pitt.edu or mike.urich@pitt.edu if you want to learn.

This guide is assuming you have a printed circuit board (PCB) design file (.brd, .gbr or other gerber files), image file (.svg), or g-code script ready to import into OtherPlan. If not, see **Simple Image to .svg Conversion With Inkscape** or other guides for the appropriate file type you wish to use.



A few ways that you can make files that the OtherMill can play with.
We're assuming you're at the OtherPlan part

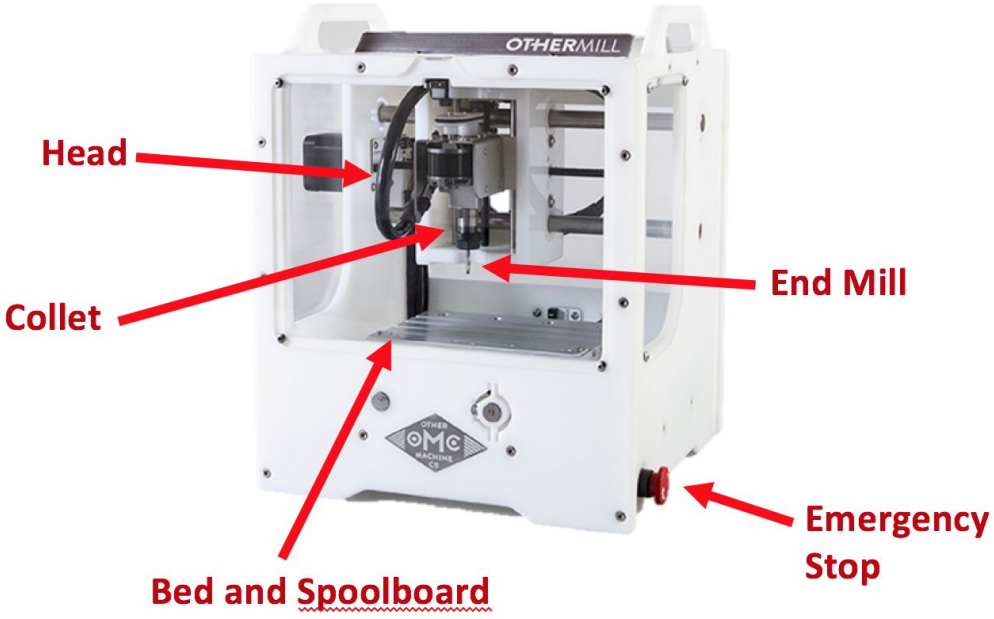
What should I use the OtherMill for?

	Should use OtherMill	Should NOT use OtherMill	Alternative?
1.	2D Cutouts of thin materials	Complex 3D cutouts on > 1 face of stock	3D Printers (Ultimaker, Lulzbot Taz)
		Cutouts for stock larger than 4" x 5" x 0.35"	Band or hand saws
2.	Fine-detail engravings	Engraving on disallowed materials*	Dremel**
		Engraving for stock larger than 4" x 5" x 0.35"	Dremel**
3.	Prototyping PCB designs	Creating PCBs expected to last forever	Order professionally

**Disallowed materials: glass, food, magnesium/other explosive metals, any material tougher than steel*
***Dremels can be used on materials tougher than steel, though not other disallowed materials; see their instructions for proper use*

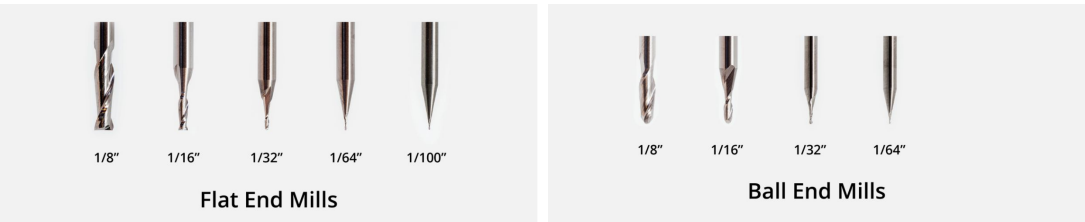
1. The OtherMill's head can only cut downward, so you cannot cutout from the sides.
2. You cannot mill materials tougher than steel, else you risk damaging bits.
3. Milling designs on FR-1 is a great way to prototype your PCB design; however, it will not have the layers of protection (i.e. silkscreen cover) that normal circuit boards have, meaning it will decay faster.

Tools/Parts

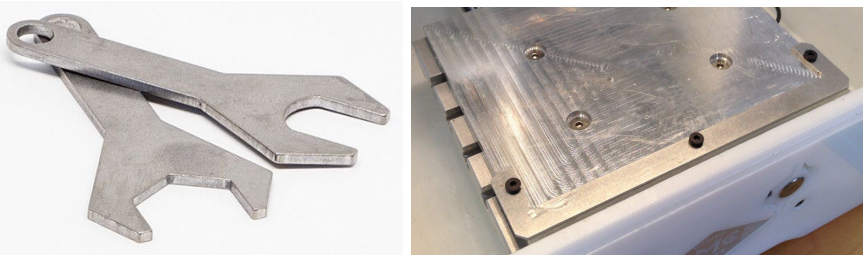


OtherMill with its parts labeled. Not shown is the power button on the back.

- Head: What actually moves around your mill to cut everything.
- Collet: What you load your mill into; connected by a nut to the head
- Emergency Stop: Press this if you need to quit a job immediately to turn off the machine. To unlatch it after it has been pressed, push the button in and twist.
- Bed and Spoolboard: Where you place your material for the OtherMill to have at it. Spoolboard size is ~4.5 x 5.5”; do not use materials of greater size than this! The spoolboard is made of aluminum, so the tools can easily cut and scratch it; be careful to try not to do so!
    - The spoolboard rests on top of the bed, and it can be removed if custom inlays are desired (i.e. you need to mill into a ball of some sort).
- End mills / tools / bits (vocab is interchangeable): These are what actually mill your material. There 3 types of bits: Flat-end, ball-end, and engraving.
    - Flat-end tools are the “typical” end mills, ranging from 1/8” to 1/64” diameter in size (smaller = slower, more precise). Good for cutting through materials and flat engravings.
    - Ball-end mills are similar to flat end, though provide better rounded finish for engravings. We only have 1/8" and 1/16” ball-end mills
    - Engraving tools are used for the tiny details. This is great for (as their name would suggest) engravings for most materials. They are VERY sharp, so use with caution. While both the 30deg and 80deg are ~1/200” at the tip, 30deg is more precise



Note that we do not have 1/100” Flat End or less than 1/16” Ball End Mills (Engraving bits not shown)



The OtherMill's wrenches and alignment bracket.

- Wrenches: Help tighten/loosen your mill
- Alignment Bracket: Small piece that can be fastened to the spoolboard that helps with alignment. It's a requirement for two-sided jobs and recommended for larger, 1 sided jobs.
    - The alignment bracket takes ~ 0.25" off of your length and width of pieces

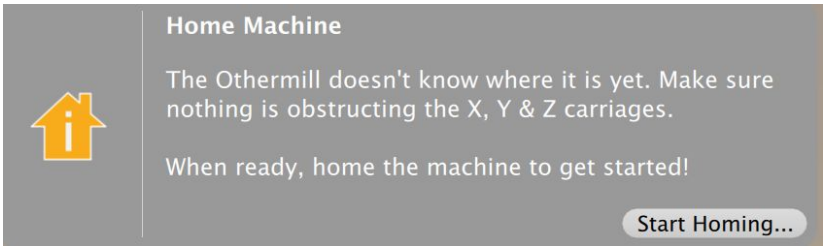
Walkthrough: One-Sided Engraving/Cutout (Easy First OtherMill Job)

Stock Material: Birch plywood, FR-1 (PCB blank)
Do NOT use: any other material (see **Tougher Materials' Jobs** guide)
Materials Needed: Stock of choice, .svg or .brd/gerber files of job you wish to do

1. Ensure the OtherMill is plugged into an AC outlet and that the USB cable is plugged into your computer, along with that there are no fluids/drinks within spilling distance of the machine. Then, turn the OtherMill on (power switch is on back face, lower-right side).

The all-important power switch. Very powerful, as it turns on the machine.

2. Start OtherPlan on your computer of choice (see **Helpful Links** if you need to install) .
3. You should be greeted with a pop-up at the bottom of the screen that says "Start Homing"; click this button to let the OtherMill establish the head's XY position. You can home the device again at any time using the button in the upper right side of the screen.



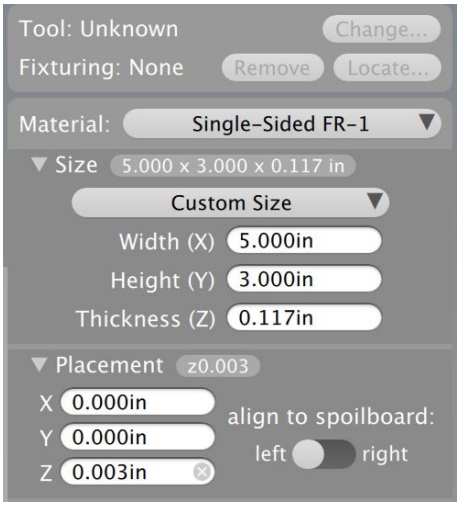
Homing your machine lets the head know where it is in XY space; we'll be locating it in Z later

4. Using the ruler and calipers by the machine, measure the dimensions of your stock
    a. Keep in mind the size of the OtherMill's bed when considering stock material. The bed size is 5.25" x 4.25" (assuming the alignment bracket is not attached)
        i. Maximum stock XY size should be ~4" x 5"; do NOT have sides of your stock hang over the bed's edge more than a few millimeters. If you're changing your tool midway through your run (as many jobs will require), you **must** have an area of the bed open for tool location later.
        ii. Maximum stock thickness should be 0.35" if a cutout is needed (use ⅛" flat-end mill); if you're not cutting out of your material and you're just engraving, stock thickness shouldn't matter - unless it's larger than the OtherMill!
        iii. **See next figure for maximum thickness cuts for each end mill**
    b. Since it's easiest to measure with these in inches, make sure OtherPlan is using inches as well instead of millimeters. To change this, go to View -> Show Units in Inches

Mill Diameter		Deepest Cut Possible
1/8”		**0.375 in.**
1/16”		**0.187 in.**
1/32”		**0.093 in.**
1/64”		**0.046 in.**

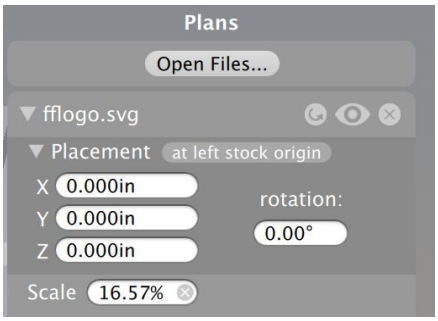
Maximum depth of cut for each of the end mills (3 times their diameter).
You should stick to performing cutouts with flat end mills if possible.

5. Select your material (“Generic” if wood, “Single-Sided FR-1” if PCB Blank) and input the dimensions you’ve measured into OtherPlan
6. Change material placement in OtherPlan to 0” x 0” x 0.003”. This offsets the tape that you will put on the bottom of your stock.



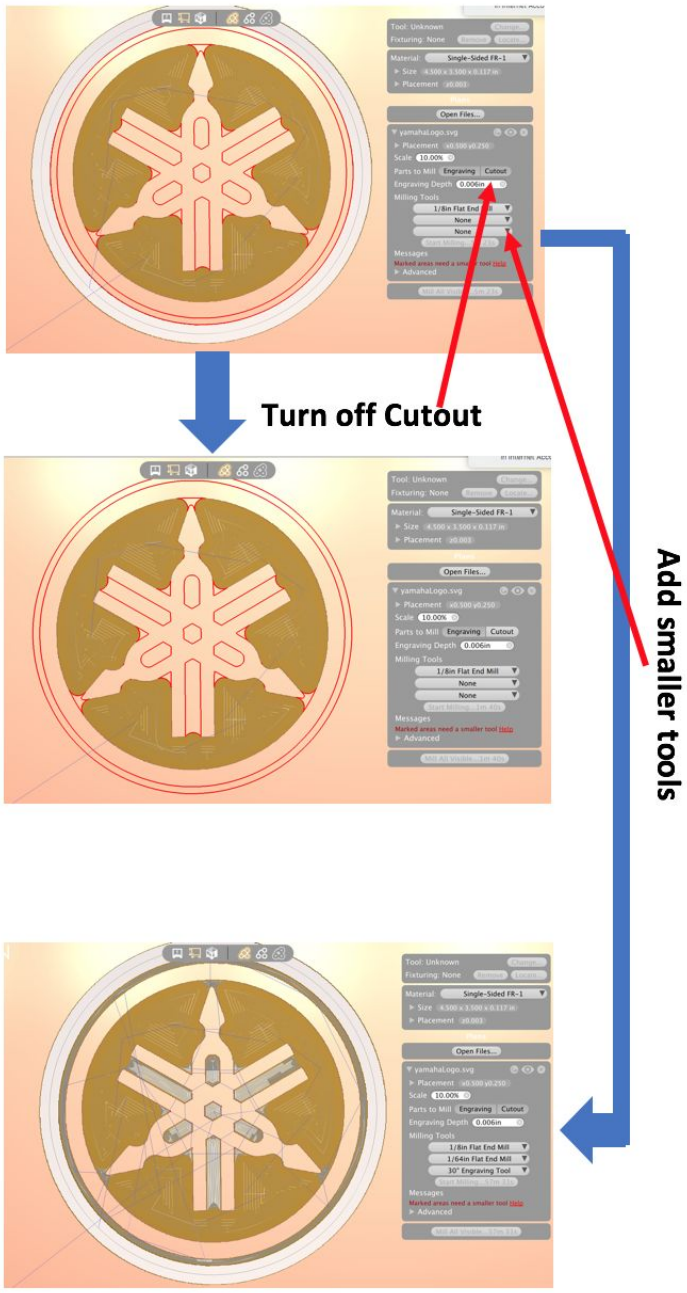
Selections, dimensions, and placement of material.

7. Import your file for milling using the “Open Files” button under “Plans”
    a. You can adjust the placement of your cutout using the Placement tab
    b. If it’s a .svg, you can scale your cutout



Import your file and move it to a different location on the stock if you desire.
.svg files can be scaled.

8. You can select on/off different components of the job depending on the type of file. There will be some differences here if you are using an image (.svg) vs. a .brd or gerber files.
    a. For images, you will be able to select “Cutout” and “Engraving” with an engraving depth.
    b. For PCB design files, you will be able to select “Traces”, “Holes”, and “Outline”. Outline and Trace are analogs to Cutout and Engraving, though you CANNOT select Trace depth in OtherPlan
9. Choose the appropriate end mills for your job
    a. Use larger mills for cutouts and thicker engravings; use smaller mills for finer engravings
    b. If you see a warning saying you need to select smaller end mills, add those in; we do NOT have 1/100” end mills (see next figure)
    c. DO NOT USE END MILLS LARGER THAN 1/32” ON FR-1 PCB BLANKS



An Aside on Engraving Depth: There should be labeled examples near the OtherMill for a few different engraving depths. In general:

- 0.003” = Just scratching the surface. Useful for thin metals.
- 0.006” = Good surface detail by appearance, will still feel almost flat
- 0.01” = Noticeably cut in by feel; the deepest an engraving bit should go
- 0.02” = Very deep engraving. Not recommended for appearance, though may be useful functionally
- > 0.02” = Should not be used for this type of job. Ask Adam or Mike if you think something would use this depth of engraving well

NOTE: It’s often easier (for planning’s sake) to do the cutout and the engravings as separate jobs; select/deselect the different sections in the view accordingly.

You can specify what parts of a job (e.g. cutout, engraving) you wish to be performed.

If you see Red areas, select smaller bits to properly mill your piece. The warning may still appear in the window, even though almost no red traces are visible. Red traces will be skipped, so choose what you wish to cut out.

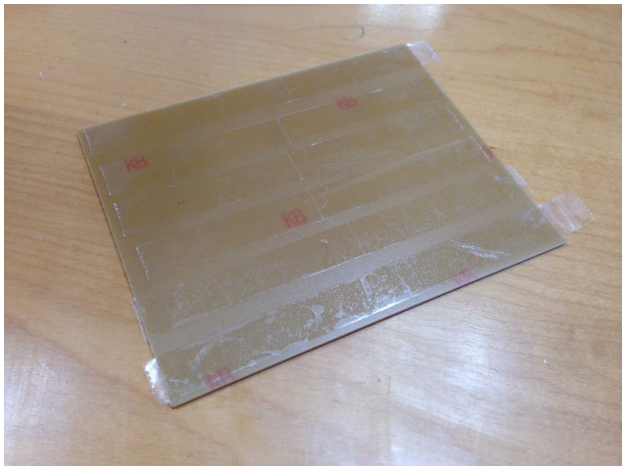
10. Look at your mills that will be used for the job; load the smallest one into the head by doing the following:
    a. In OtherPlan, press the “Change” button at the upper right corner of the screen. The head should move to the center of the machine, and a window should then pop up at the bottom of the screen.

“Change” will take you through changing a tool, while “Locate” will bring the head to its (0,0) coordinate

    b. If there is a tool present in the OtherMill, we must remove it.
        i. To do this, first take the two wrenches on top of the OtherMill. Use the small wrench to hold the neck of the head in place and the larger wrench to loosen the nut (hold top steady, turn clockwise with respect to birds-eye view).
        ii. After the initial loosening from its starting point, you should hit a point where you have to apply a bit more force to loosen it; do this, and afterwards you should be able to remove the tool
    c. Now that the collet is open, place your new tool in.
        i. To do this, first ensure the nut is loose by hand (should spin freely to either side). If it is not, loosen it with the wrenches as if removing a tool.
        ii. Place the tool into the head, fluted-side down. You should place it so about ¾ of the mill’s shaft is in the head. Keep a hand under the mill (in case it falls) and gently tighten the nut by hand for a few turns until the neck starts turning with it.
        iii. Take the wrenches (small one on neck, large one on nut) and tighten by holding the neck still and rotation the nut counterclockwise with respect to birds-eye view (right) until it is snug; DO NOT OVER-TIGHTEN YOUR TOOL
    d. Now that the tool has been switched out, in the window at the bottom of your screen, select the tool you just inserted then click OK. You will be asked to Locate Tool.
        i. Ensure that your tool is over an empty section of the bed before selecting Locate. Use the X and Y arrows on the screen to move the head.
            1. Also be sure that the tip of your tool is clean; the locating uses electrical conductivity to determine when the tool touches the bed
            2. **Pro-tip**: locating your tool near the far edge of the bed (where your stock material won’t be) will make it easier to locate again if you have to switch tools mid-way through your job
        ii. Press “Locate” and watch the tool gently touch the bed. This tells the machine where the tool is in the Z-plane (depth)
        iii. If you see it about to collide with anything, hit the Emergency Button on the machine or ESC on your computer

NOTE: Remember that this tutorial is NOT meant to be used on materials aside from soft woods (birch plywood, for example) or FR-1 (PCB blanks). These materials work fine with OtherPlan's default tool settings, though these may break the end mills if used on tougher materials. If you are using a tougher material, contact the OtherMill trainers for different tutorials.

11. Load your material to the bed. To do this, place double-sided Scotch tape along the bottom of your material. Ensure you cover any areas that you will be cutting out so that they don't fly off when the cutout completes. Then simply place your material on the bed, flush with the lower-left corner.
    a. If your job doesn't take up much of the spoolboard/material, you can leave a small amount of your stock over the spoolboard's edge to make it easier to remove later
    b. If you will be changing materials within your job, make sure enough of the bed is open to locate your tool later



Your stock should be comfortably covered in tape for this tutorial.

12. Run down the **"Before You Hit Start Milling"** checklist:

1. Ensure your material is secure and will NOT move
2. Check that the thickness of the material is correct in OtherPlan
3. Ensure your mill is securely tightened
4. Make sure all glass windows are securely attached
5. If you're using multiple tools for the cut, make sure you have open space on the bed to locate your tool
    a. For tough materials, make sure custom mills in OtherPlan are selected

13. Hit start; it will tell you to insert tool if you need to change it. Carefully watch the head to ensure your job starts cleanly
    a. Change tools and relocate as needed throughout your job
    b. If your piece comes off during the run, stop the job (emergency button or ESC on your computer while in OtherPlan) and check the **FAQ** section for how to avoid this in the future.

WHEN DONE: immediately vacuum up the dust created. Be careful: if you didn't secure your pieces well, they can be vacuumed up! If that's the case just push the dust off to the side, remove your piece, then vacuum. Use a spatula, painter knife, or exacto knife to remove your piece. But if you say…

"My piece is stuck on the bed! Help!"

Turn off the OtherMill and gently drop small amounts of ethanol around the edges of your piece. This should loosen up the tape's adhesion.

Ensure you vacuum the whole area. Afterwards, remove your tool and put it away (clean it off with a microfiber cloth and ethanol if needed).

NOTE: If you used FR-1 and noticed that the holes did not go 100% of the way through the board after taking your piece off, use the exactoknife at the OM station to poke the small pices of fiberglass left on the bottom of the board. It should take incredibly little force.

FAQs and Troubleshooting

Q: I forgot to change my thickness measurement and scratched the spoolboard with the end mill! What do I do?
A: Step 1, alert the volunteer on duty at the time so they can document it. Don't worry, it's not the end of the world, just a minor annoyance. The spoolboard is made of aluminum, so it's made to be scratched by the steel end mill. If the scratch isn't too bad and we can still easily place stocks on it flatly, we'll probably just ignore it for a while. Eventually, we can reface the spoolboard or get a new one.

Q: The OtherMill started to drill into my material, it got jammed and shut down. What happened? What should I do?
A: You probably either a) set your thickness too thin, so the mill tried to go deeper, or b) you used too high of speed/feed for the given material with the mill used. Always use the "Before You Mill" checklist before starting!

Q: My material came of the bed as I was milling! What do I do?
A: Hopefully you stopped the job (emergency button or ESC). This happens because of a combination of 1. The stock not being secured enough, and 2. Too much torque being generated by a bit against the material. You can address each of these individually in your next attempt: for 1. use a stronger securing mechanism (P-02 or hot glue), and for 2. Use smaller bits. Remember, for FR-1, DO NOT USE A BIT LARGER THAN 1/32"!!! Additionally, you could add a custom tool in OtherPlan that has lower pass and plunge depth settings than the default; if you wish to do this, ask the OtherMill trainers for details.

Q: The machine performed the job fine, but my engravings came out fuzzy. Why did this happen and what can I do?
A: This is a symptom of a gummed or dulled bit. Let us know so we can either clean it or replace it accordingly. For now, you can either use an exacto knife and sanding to remove the excess, or do the job again with different bits.

Q: I broke a bit!
A: That's not really a question, but how? Let us know, we'll figure out how to get a replacement.

Before You Hit “Start Milling”

1. Ensure your material is secure and will NOT move
2. Check that the thickness of the material is correct in OtherPlan
3. Ensure your mill is securely tightened
4. Make sure all glass windows are securely attached
5. If you’re using multiple tools for the cut, make sure you have open space on the bed to locate your tool
    a. For tough materials, make sure custom mills in OtherPlan are selected

Helpful Links

OtherPlan install page: https://othermachine.co/otherplan/
OtherMill support page: https://othermachine.co/support/
OtherMachine help request*: https://othermachine.co/support/contact/
Refacing spoolboard: https://othermachine.co/support/techniques/facing-spoilboard/
Basic maintenance: https://othermachine.co/support/techniques/maintenance/
CAD and CAM (softwares for 3D): https://othermachine.co/support/2d-3d-design/cad-and-cam/
Fusion 360 (Free CAD/CAM software): https://othermachine.co/support/2d-3d-design/fusion-360/
Inkscape download: https://inkscape.org/en/download/
EAGLE download: https://www.autodesk.com/products/eagle/free-download

*OtherMachine says they are working on adding forums. Until then, any questions that can’t be addressed by OtherMill trainers will go to through a help request.

Materials Guide (Last updated 8/9/17)

Material	End Mill	Feed Rate	Plunge Rate	Spindle Speed	Pass Depth
Wood - Softer (Birch Plywood)	1/8" Flat	23.622 in/min	1.575 in/min	12000 RPM	0.01"
Fix: Scotch for thinner	1/16" Flat	23.622 in/min	1.575 in/min	12000 RPM	0.01"
P-02 or hot glue for >0.1"	1/32" Flat	23.622 in/min	1.575 in/min	12000 RPM	0.01"
	1/64" Flat	23.622 in/min	1.575 in/min	12000 RPM	0.01"
	Engraving (1/200")	39.37 in/min	1.575 in/min	12000 RPM	0.003"

Material	End Mill	Feed Rate	Plunge Rate	Spindle Speed	Pass Depth
Aluminum (6061)					
Fix: Hot glue and P-02	*1/8" Flat*	7.087 in/min	0.591 in/min	12000 RPM	0.002"
Note: Use align. bracket	*1/16" Flat*	7.087 in/min	0.591 in/min	12000 RPM	0.002"
only cutout with 1/8"	*1/32" Flat*	7.087 in/min	0.591 in/min	12000 RPM	0.002"
Ensure piece isn't warped	*1/64" Flat*	1.417 in/min	0.157 in/min	12000 RPM	0.001"
Don't engrave > 0.01in	*1/100" Flat*	1.417 in/min	0.157 in/min	12000 RPM	0.001"
Brass (360)	*1/8" Flat*	7.874 in/min	0.656 in/min	12000 RPM	0.002"
Fix: Hot glue and P-02	*1/16" Flat*	7.874 in/min	0.656 in/min	12000 RPM	0.002"
Note: Use align. bracket	*1/32" Flat*	7.874 in/min	0.656 in/min	12000 RPM	0.002"
only cutout with 1/8"	*1/64" Flat*	1.575 in/min	0.157 in/min	12000 RPM	0.001"
Ensure piece isn't warped	*1/100" Flat*	1.575 in/min	0.157 in/min	12000 RPM	0.001"
Don't engrave > 0.01in	*Engraving (1/200")*	7.874 in/min	0.656 in/min	12000 RPM	0.002"

Material	End Mill	Feed Rate	Plunge Rate	Spindle Speed	Pass Depth
FR-1 (PCB blanks)	*1/8" Flat*	14.173 in/min	1.81 in/min	12000 RPM	0.005"
Fix: scotch tape (mostly)	*1/16" Flat*	14.173 in/min	1.81 in/min	12000 RPM	0.005"
Note: Ensure board is flat;	*1/32" Flat*	14.173 in/min	1.81 in/min	12000 RPM	0.006"
use hot glue bead or P-02	*1/64" Flat*	5.669 in/min	0.472 in/min	12000 RPM	0.002"
to hold flat if needed	*1/100" Flat*	5.669 in/min	0.472 in/min	12000 RPM	0.002"
Machinable Foam	*1/8" Flat*	31.496 in/min	1.575 in/min	12000 RPM	0.011"
Fix: P-02 and hot glue	*1/16" Flat*	31.496 in/min	1.575 in/min	12000 RPM	0.012"
Note: only cutout with 1/8"	*1/32" Flat*	31.496 in/min	1.575 in/min	12000 RPM	0.013"
and 1/16", use align. brack.	*1/64" Flat*	31.496 in/min	1.575 in/min	12000 RPM	0.004"
Be careful with engraving	*Engraving (1/200")*	31.496 in/min	1.575 in/min	12000 RPM	0.003"
Machining Wax	*1/8" Flat*	37.402 in/min	1.575 in/min	12000 RPM	0.013"
Fix: P-02 and hot glue	*1/16" Flat*	37.402 in/min	1.575 in/min	12000 RPM	0.014"
Note: only cutout with 1/8"	*1/32" Flat*	37.402 in/min	1.575 in/min	12000 RPM	0.016"
and 1/16", use align. brack.	*1/64" Flat*	37.402 in/min	1.575 in/min	12000 RPM	0.005"
Be careful with engraving	*Engraving (1/200")*	39.370 in/min	1.575 in/min	12000 RPM	0.003"

Material	End Mill	Feed Rate	Plunge Rate	Spindle Speed	Pass Depth
ABS					
Fix: scotch for thin	*1/16" Flat*	23.622 in/min	1.575 in/min	12000 RPM	0.009"
P-02 for thick (>0.1")	*1/32" Flat*	23.622 in/min	1.575 in/min	12000 RPM	0.009"
Note: Don't use 1/8" bits	*1/64" Flat*	23.622 in/min	1.575 in/min	12000 RPM	0.009"
or hot glue for fixture	*Engraving (1/200")*	40 in/min	1.575 in/min	12000 RPM	0.006"
Acrylic					
Fix: scotch for thin	*1/8" Flat**	59 in/min	1.81 in/min	16400 RPM	0.005"
P-02 for thick (>0.1")	*1/16" Flat**	43.3 in/min	1.81 in/min	16400 RPM	0.003"
Note: Pause to clean scraps	*1/32" Flat*	23.622 in/min	1.575 in/min	12000 RPM	0.01"
during larger jobs	*1/64" Flat*	23.622 in/min	1.575 in/min	12000 RPM	0.01"
Delrin					
Fix: hot glue for engraving	*1/8" Flat*	23.622 in/min	1.575 in/min	12000 RPM	0.008"
P-02 for cutouts	*1/16" Flat*	23.622 in/min	1.575 in/min	12000 RPM	0.02"
	1/32" Flat	23.622 in/min	1.575 in/min	12000 RPM	0.02"
	1/64" Flat	23.622 in/min	1.575 in/min	12000 RPM	0.003"
	1/100" Flat	23.622 in/min	1.575 in/min	12000 RPM	0.003"
	Engraving (1/200")	23.622 in/min	1.575 in/min	12000 RPM	0.003"
HDPE					
Fix: hot glue for engraving	*1/8" Flat*	23.622 in/min	1.575 in/min	12000 RPM	0.008"
P-02 for cutouts	*1/16" Flat*	23.622 in/min	1.575 in/min	12000 RPM	0.009"
	1/32" Flat	23.622 in/min	1.575 in/min	12000 RPM	0.010"
	1/64" Flat	23.622 in/min	1.575 in/min	12000 RPM	0.003"
	1/100" Flat	23.622 in/min	1.575 in/min	12000 RPM	0.003"
	Engraving (1/200")	39.370 in/min	1.575 in/min	12000 RPM	0.003"
Polycarbonate					
Fix: hot glue for engraving	*1/8" Flat*	39.370 in/min	1.81 in/min	12000 RPM	0.01"
P-02 for cutouts	*1/16" Flat*	14.173 in/min	1.81 in/min	12000 RPM	0.01"
Note: Pause to clean scraps	*1/32" Flat*	23.62 in/min	1.575 in/min	12000 RPM	0.01"
during larger jobs	*1/64" Flat*	23.62 in/min	1.575 in/min	12000 RPM	0.01"
	Engraving (1/200")	39.37 in/min	1.575 in/min	12000 RPM	0.006"

Simple Image to .svg Conversion With Inkscape

For using the OtherMill (and any other CNC routing), simple .jpeg or .png bitmaps cannot be immediately used as a design for milling. Image files need to be converted to a monochromatic type that can simply state “cut here, and do not cut here”.

While there are a few different file types that support this, the easiest to access is the .svg file. Not many image softwares support conversion to .svg, though one of the most convenient of these (and free-est to use) is *Inkscape*. This tutorial will take you through downloading Inkscape, importing your image, and then exporting it as a .svg file that OtherPlan can import.

It is recommended that you have your image as close to what you desire as possible before conversion (i.e. if it has a lot of colors, make it black and white beforehand). Image editing can be done in software of your choice, though editing in Microsoft Powerpoint and doing a screenshot of the result seems to work fine.

Once your image is ready:

1. Download Inkscape at https://inkscape.org/en/download/
    a. Skip this step if the computer you’re working on already has Inkscape
    b. Mac users will also have to download XQuartz and restart their computer
2. Open Inkscape and import your image file by selecting File > Open. A window will pop-up after selection with details about the import; just click OK
3. Select your image on the page, then in the top toolbar click Path > Trace Bitmap
4. A window will pop up with many options. Select Live Preview to see what the .svg trace will look like.
    a. You can play with the different options until the preview looks like you want it too. You select what criteria to base the conversion off of and adjust accordingly.
        i. Brightness cutoff: Pixels below selected brightness are kept and made black. The same as a simple threshold to black and white.
        ii. Edge Detection: Attempts to find edges and create traces along them.
        iii. Color Quantization: No idea how this works, feel free to try it though.
        iv. Do not use the Multiple Scans options. These will not create a simple path for the OtherMill to follow and the files produced will not mirror how OtherPlan actually reads them.
    b. If your image is pretty distinct and is monochromatic, you’re probably fine to just hit OK.
5. Once the Live Preview window looks how you want, press OK. This will overlay the vector path on top of your image. Remove your original image to see the vector path alone.
6. From here, press File > Save As, and make sure to change the type to .svg
    a. It doesn’t matter if you select “Inkscape SVG” or “Plain SVG” in our experience

OTHER SECTIONS OF GUIDE STILL IN PROGRESS:

Walkthrough: Two-Sided engraving and cutout

TODO: write it out cleanly, add pictures

Two-sided cuts are very similar to one-sided except that we have to flip our stock between the two sides. The most common use for this would be a two-sided PCB.

- Place on alignment bracket
- Load otherplan, it'll check for the alignment bracket, wow it works
- Measure stock, max is probs 4.25x4" or so for this bc of alignment bracket :/
- Load stock w/tape on lower left hand corner of alignment bracket (note; your stock dimensions should be dead on)
- Make sure "front" is selected if for a PCB file and do the **engraving only, not the cutout** just like you would for a one sided piece.
    - While .brd files will have data for front/back of PCBs, there's no "easy" way that we know of to do two sided engravings otherwise (i.e. if you wanted to make a coin). I'd still recommend using the alignment bracket, and make sure to carefully measure your design so that when you flip the stock over it will align correctly with the second engraving (make sure to save the cutout part for after the flip). Alternatively, if it's possible, it may be easier to cut out the front and back on separate parts of the stock measured out to the same size in one go, then to just glue the two together.
- Flip the stock, retape and such aligned with right side of alignment bracket
- Select "back" and do **engraving and cutout**

Walkthrough: Custom Inlay

TODO: actually learn how to do this and try it

http://blog.othermachine.co/otheryo-the-making-of-a-delrin

Walkthrough: Tougher Materials' Jobs

TODO: write up properly

- Look at the materials guide for the speeds and feeds needed for your material in question
- In Otherplan, go to File > Tool Library
- Either:
    - A. Write in the stats from the Materials guide to make new tools
    - B. Import the tool files from our repository
- From here, set these as your tools for your jobs. Estimation times should change (probably a heck of a lot slower!
- MAKE SURE YOUR MATERIALS ARE SECURE!!! I highly recommend using hot glue and P-02, though just check the "fix" in the materials guide

Run it; keep an eye on it.

Tips and Tricks

TODO: as things come up, add them here

EAGLE/Fritzing Guide For .brd or gerber Files

TODO: @Mike write-up

CAD/CAM Guide

TODO: actually learn how to do this and try it

Overall guide stuff to do for Adam and Mike:

EAGLE:

- Simple tutorial for designing a PCB. probably just something simple that doesn't take much material, make the schematic, let it automatically generate the pcb, export
    - I'm 99.9% sure autogenerate exists but I'm not sure how it works. Does it auto pick # of layers?
- Post generation, I know you can tweak and optimize it from there, not sure if that's necessary for this level. It may be helpful if the stuff generated in EAGLE is too high res and we need to make stuff a bit bigger to work with the OtherMill
- Note that otherplan can only do two-sided (two-layered) pcbs; the point of this is for prototyping your product's PCB quickly. If you want something super upscale with tons of layers and shit get reallll good at EAGLE and send it to real people, though this is a good quick way to try stuff out!

Fritzing:

- You can export gerber files from fritzing, which apparently can work too! Same way as the stuff I said above with eagle, though maybe fritzing is easier?
- Example of using it for arduino shield; we can base off of this http://teachmetomake.com/wordpress/using-fritzing-to-design-an-arduino-shield-and-using-OtherMill-to-mill-the-board

G-Code:

- Accepted G-codes resources: https://othermachine.co/support/techniques/gcode-reference/
    - Unless we really know what the heck we're doing, we probably shouldn't use these, but this level of specification may be useful if we can't otherwise learn how to do different depths outside of cutout/engrave while milling
- More useful here would be starting with a solidworks file or something similar and finding a g-code generator to make the appropriate g-code from the .stl or something, which can then be imported to otherplan

Example ideas, Easy "Test Projects", or things useful for the room that we could make

SYNTHESIZER THING: http://www.instructables.com/id/8-bit-Synth-Awesomeness-with-the-OtherMill/

- For wood engraving, simple coaster w/ multiple tiers of depth?? Maybe something a bit more functional would be nice
- 3D stuff???
- For PCB, maybe simple light detection circuit (turns off LED when photoresistor gets light or something)

- For project, we'd want to try to make something that encompasses:
    - PCB cutting
    - Wood milling
    - Plastic milling?
    - Something 2-sided
    - Something 3D (not just one tier of engravement depth, think like that little fan)
    - Something useful for the room

Things the room needs:

- Organization for all of the OtherMill's associated crap (bits, materials, tools we use with it, etc)
- Something with the clock/bell ringing idea…?
    - Not sure how to actually do the clock part without digital aid, but o/w we have all the materials
    - PCB for clock electronics and hookup to "bell", could we mill out enclosure for it maybe?