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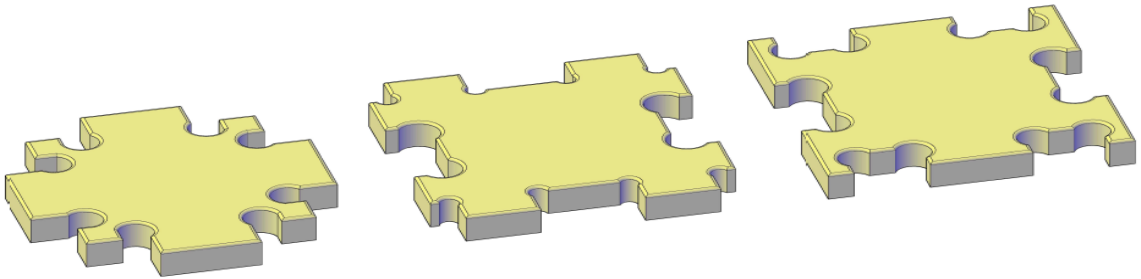
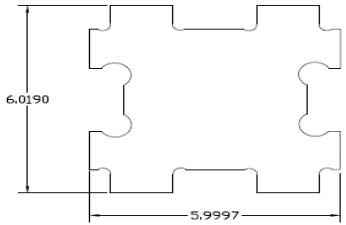


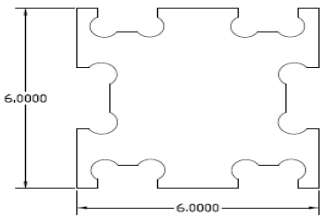
2 Isometric 3D Rendering N/A

Make 2



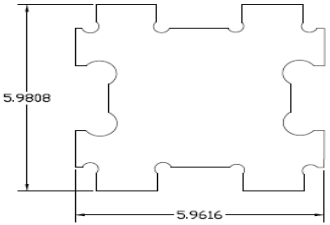
2 Piece 1 N/A

Make 2



3 Puzzle Piece 2 N/A

Make 2



4 Puzzle Piece 3 ******

Puzzle Cube

PROJECT

Puzzle Cube Overview

TITLE

DATE 03/22/2015

SCALE As Noted

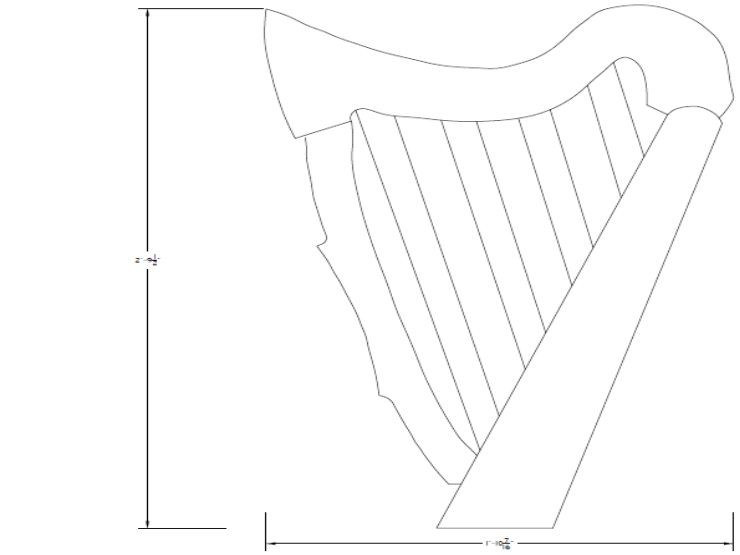
DRAWN BY JC

CHECKED BY JC

PC - 1

PAGE 1 OF 1

Drafting - continued



FRONT VIEW
YAROHARP

Yaro Harp

PROJECT

Irene's Harp Engraving

TITLE

DATE 04/15/2015

SCALE As Noted

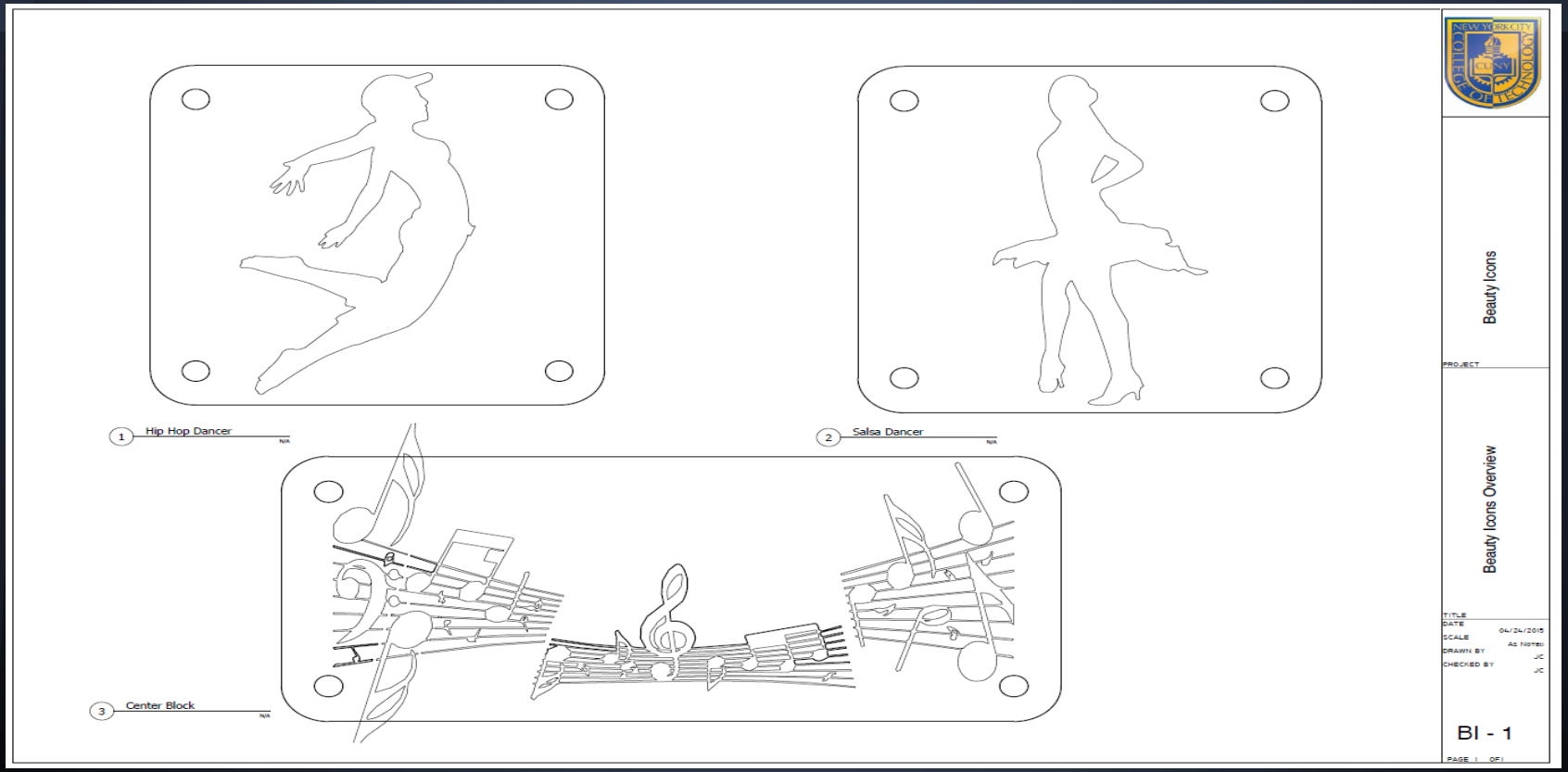
DRAWN BY JC

CHECKED BY JC

IH - 1

PAGE 1 OF 1

Drafting - continued



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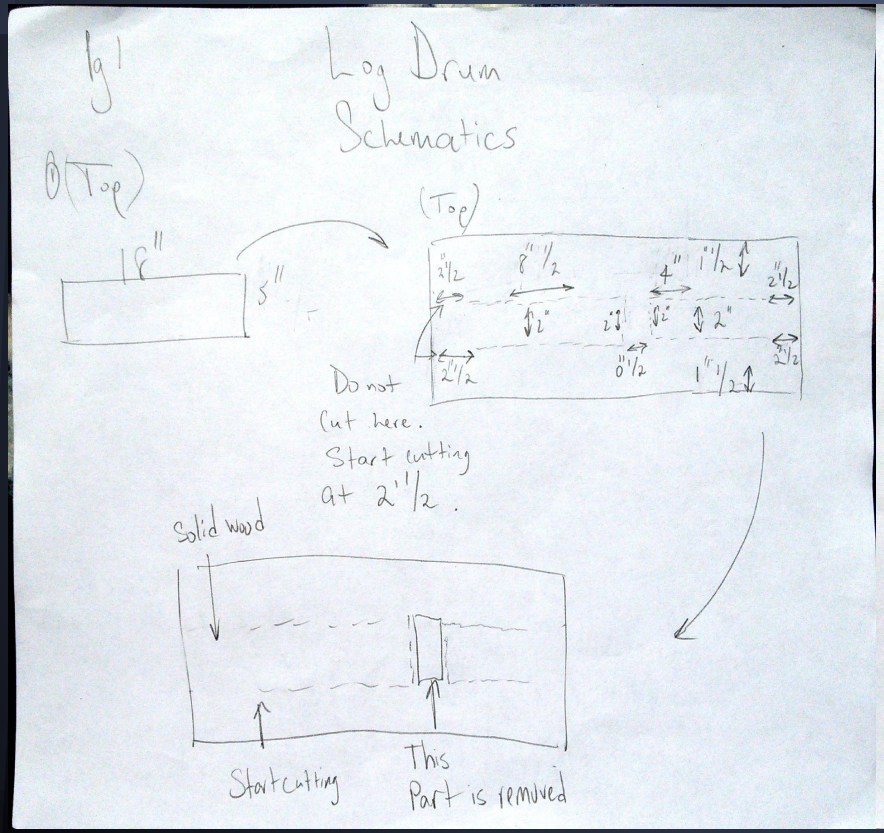

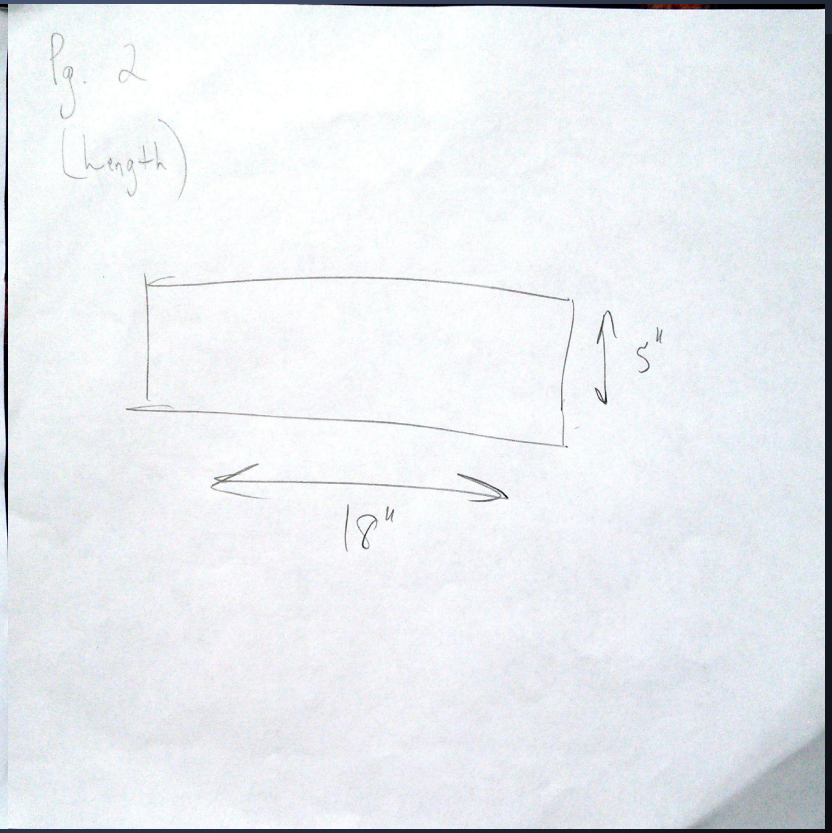

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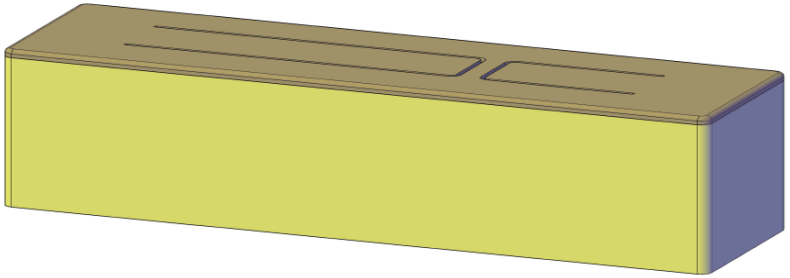
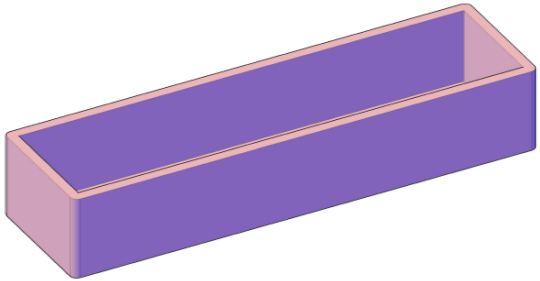


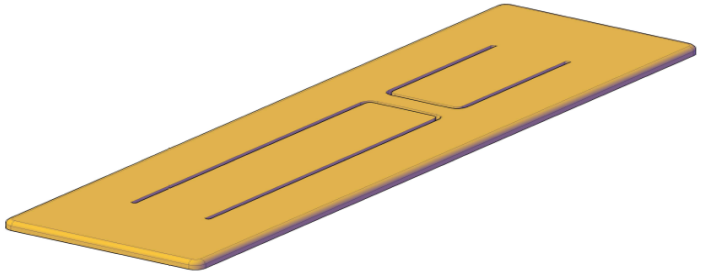
Dimensions : L 18" X W5" X H 5 $\frac{1}{4}$"

Materials: Black Walnut Top
Bottom Pine

1 Log Drum Illustration
N/A



2 Log Drum Bottom
N/A



3 Log Drum Top
N/A

NEW YORK CITY COLLEGE OF TECHNOLOGY CUNY

Log Drum

PROJECT

Log Drum Isometric

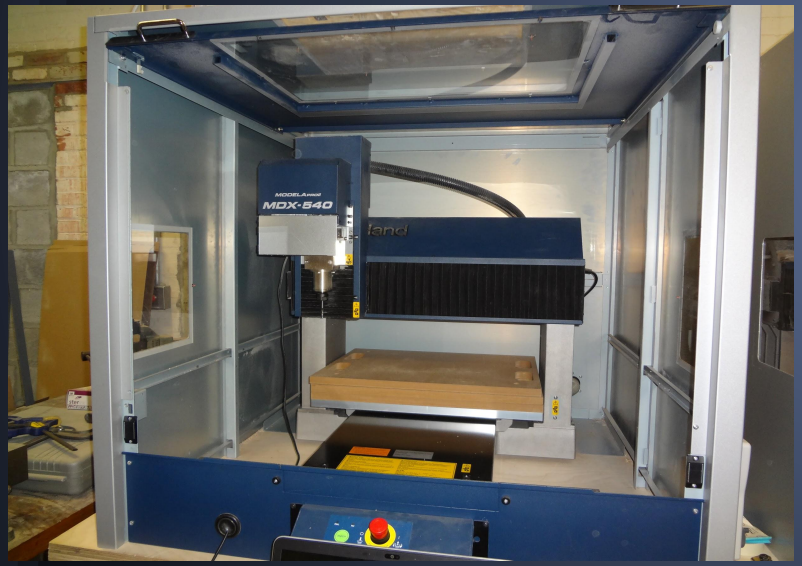
TITLE
DATE 04/12/2015
SCALE N/A
DRAWN BY JC
CHECKED BY JC

LG - 1

PAGE 1 OF 1

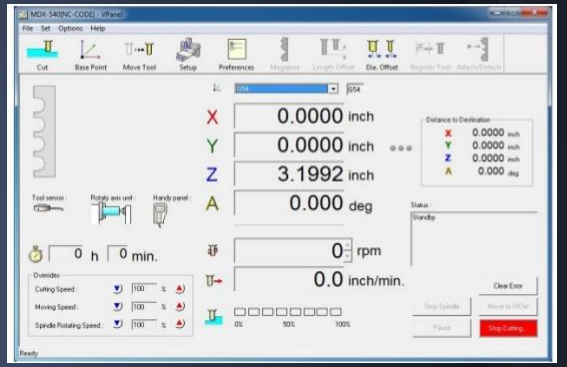
Roland MDX overview

Roland MDX-540 3-Axis CNC Mill is used at NYCCT along with Rhino CAM. As with any automated tool *MAKE SURE THE E-STOP IS ENGAGED!!*

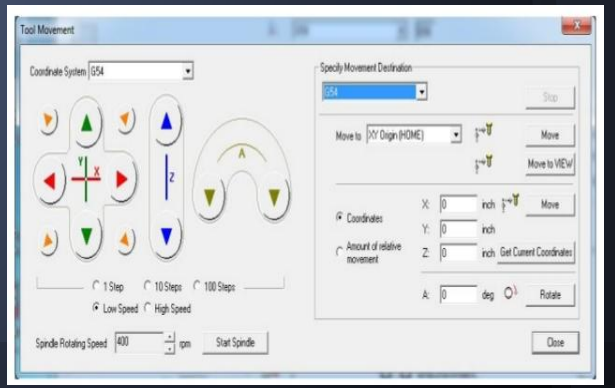


Specs: 19.6" x 15.7" Bed, 12,000RPM Spindle, Single tool (auto tool changer is optional)

Upper Right. This screen shows the position of the cutting tool for the X,Y, Z Coordinates in relation to the table bed. The screen also monitors the time required to complete the job, SS and FR.

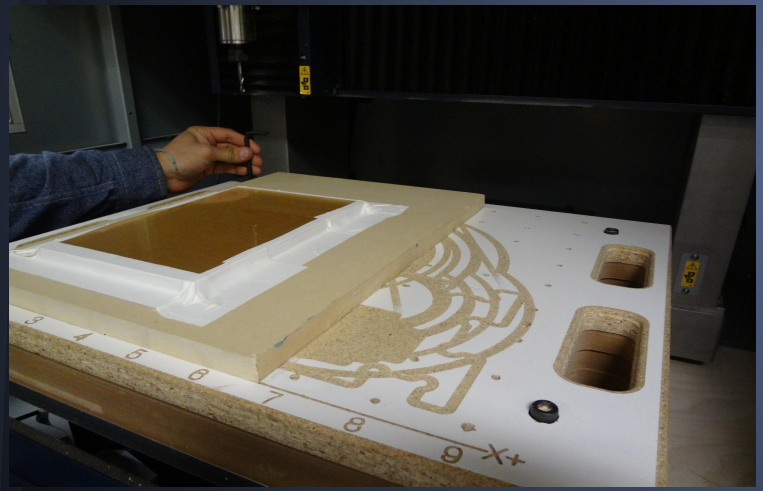


Lower Right. This screen shows the current G code being set. Set the SS setting, move the Spindle to “home”. We can also “jog” the machine which is useful for “homing” the X,Y,Z planes.



Preparing for CNC Cutting

Although CNC machines can cut very quickly and precisely requires much preparation. Here are some of the steps you need to take in order to set up and cut/route what you want.

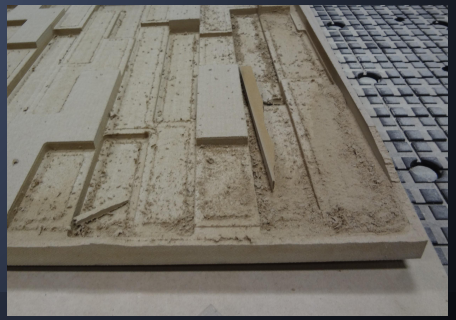


The Roland MDX-540 cutting Bed is underneath the white composite board. The MDF is screwed on to the whiteboard using drywall screws. This board decreases the cutting area to 16”x16” but creates a failsafe for cutting into the actual bed and keeping whiting the X-Y limits

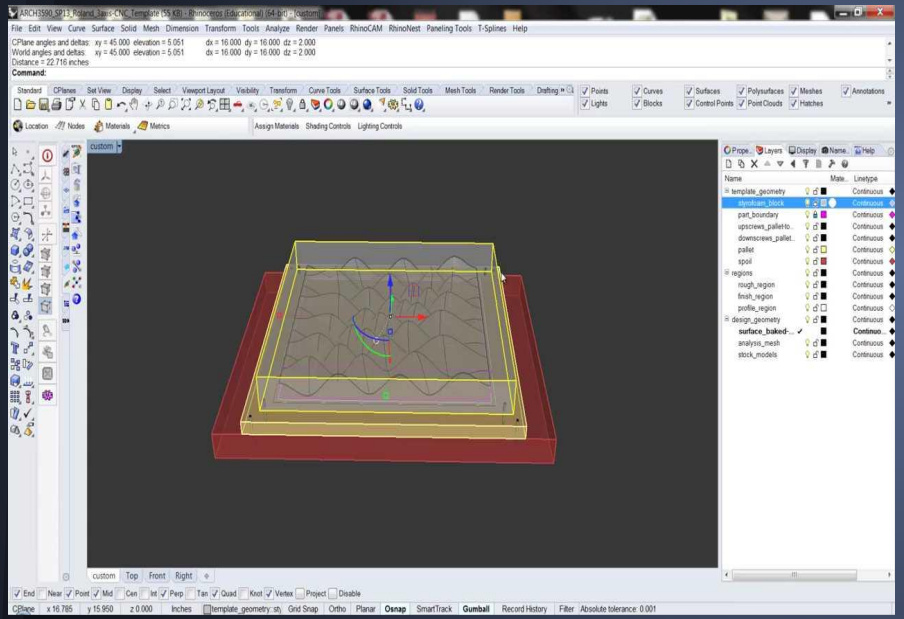
Step 1. You want to make sure that your material is very secure. If the material comes loose during cutting it will most likely be “off” and also get mangled.

Here we have secured this plexi with gaff tape and 3M 27 Spray adhesive to ¾” MDF.

Particle boards have a tendency to concave when being hogged out. Notice the MDF curving off the spoilboard.



Preparing for CNC Cutting - Continued

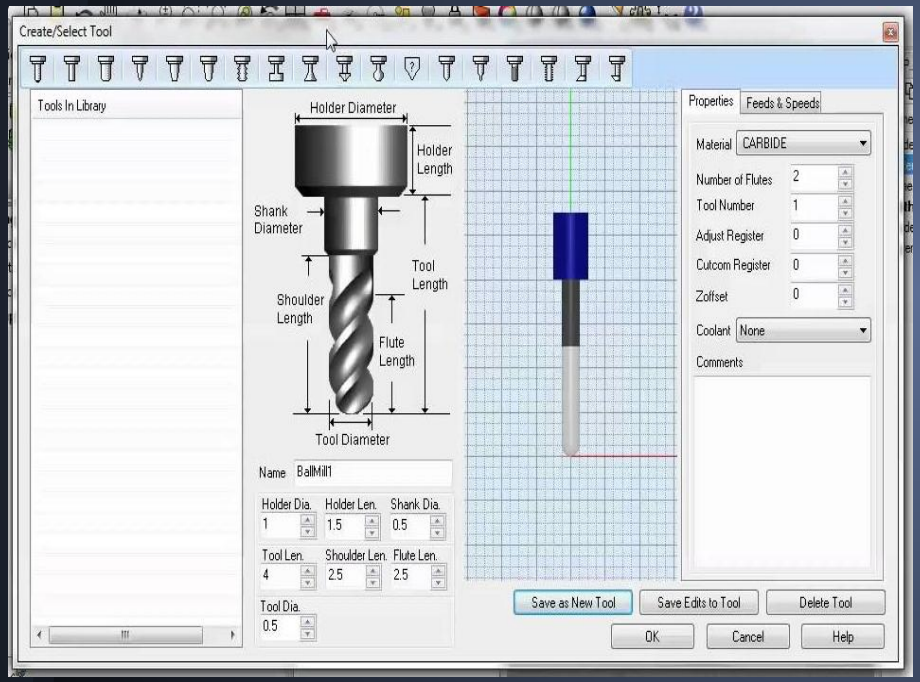


The Program used above is RhinoCAM. Notice the similarities with a CAD Program. We also see from the bottom up the cutting bed, spoil board and material

Step 2. Setting up the geometry in CAM. Here we can tell the CNC machine the size of the cutting bed, size of material being cut and depth for the tool to cut through.

The name engraved in the piece was actually done with Rhino CAM. Due to the similarities in interface and operation I was able to set this up within minutes of first working with the program

Preparing for CNC Cutting - Continued



Above. This is the tool selection screen in RhinoCAM. Notice the many specs we get for this individual tool

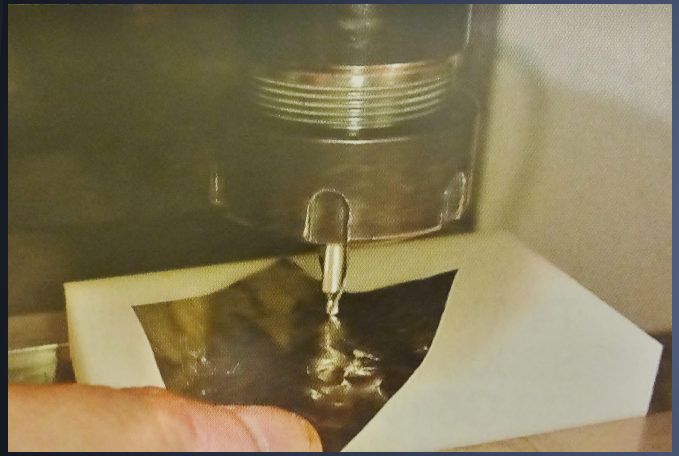
Step 3. You need to choose the proper tool(s) to complete the job.The tool that you choose will have an effect on spindle speed, plunge rate, feed rate.

Once the tool is chosen you can review the tool path and generate the G-Code. Swapping tools is much like swapping bits on a hand router.

Right. Here we have the collet and screw cap plus some cutting tools

Far Right. Is a full tool holding assembly with a V-Groove tool ready to be inserted into the spindle.

Preparing for CNC Cutting - Continued

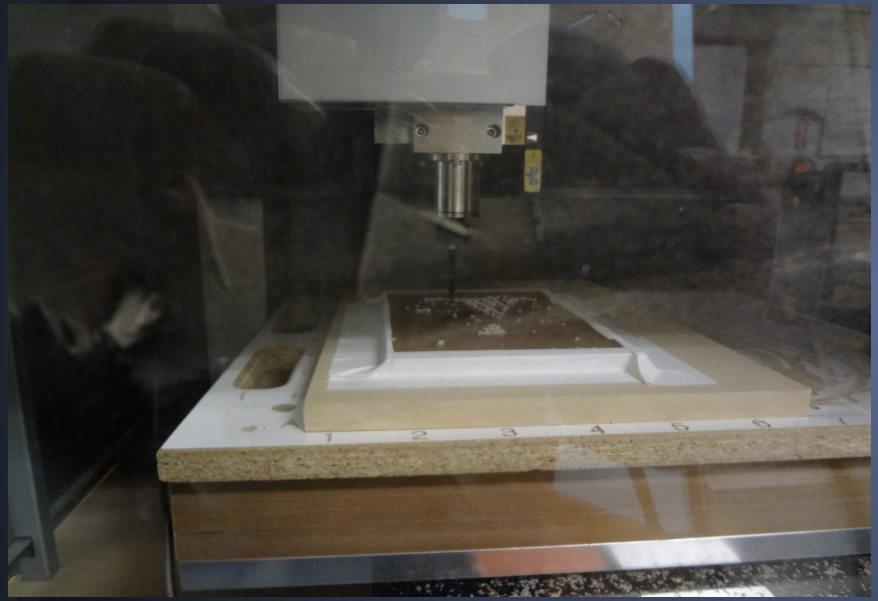


The Z axis is being homed. Here the operator is using a .001” Shim, however a sheet of paper can also be used when the thickness is not extremely critical. Homing the Z axis will let us accurately set cut depths into the material

Step 4. Once you have the G-Code you then need to home the machine for the X-Y Axis as well as the Z axis.

The X-Y home can be placed anywhere on the cutting bed but for ease of use it is usually set at to a corner on the the cutting bed.

Actual cutting!

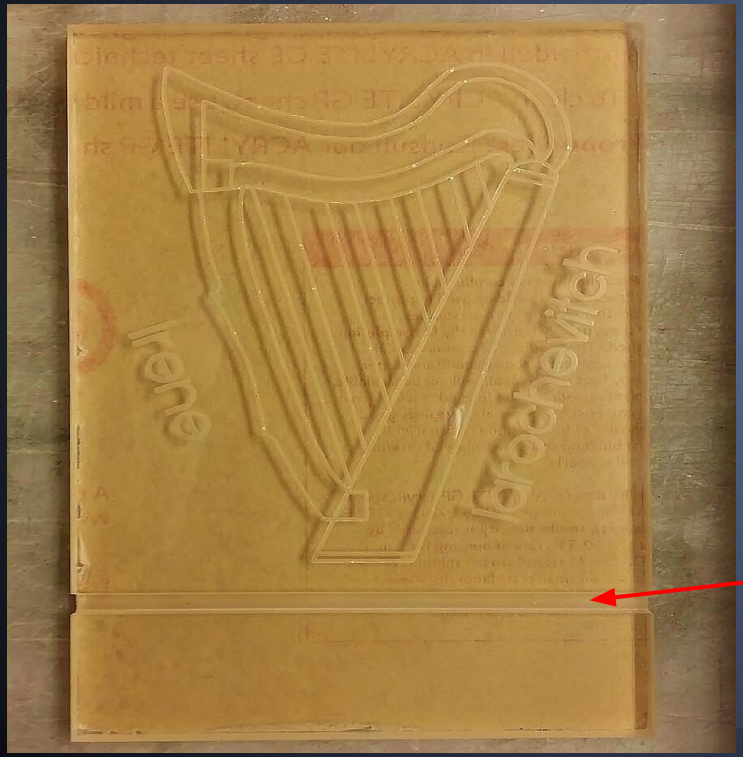


Step 5. Once the machine is home, the G- Code is ready, the proper tool is attached and your material is secure then you are ready to cut. *Don't Forget to disengage the E-Stop.*

Monitor the machine as it cuts. sometimes the machine may crash and will need to be restarted. A crash may not just damage your material but also the machine itself. In addition always wear safety goggles as pieces can fly out unexpectedly.

CNC Machines are loud during operation use hearing protection and eye protection at all times

Admire Your work

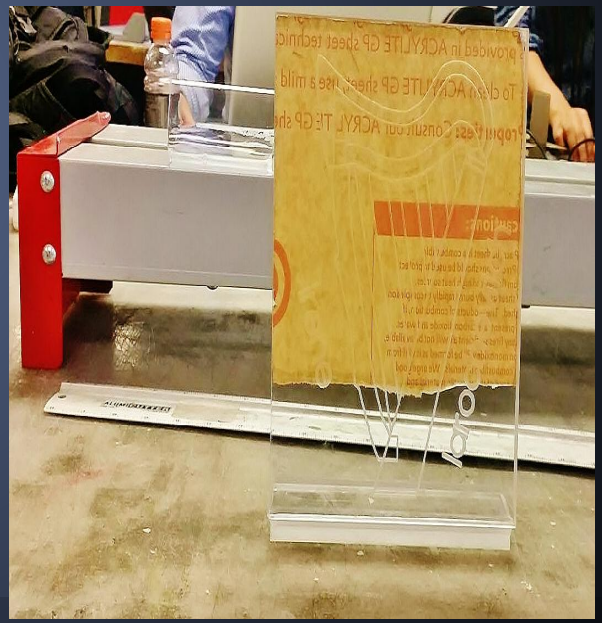


Step 5. Inspect the piece to make sure it is cut to your specifications. This is especially important when cutting interlocking pieces. Most importantly enjoy, share and admire your work!

The score line was made using a ¼" Solid Steel Flat Tip Single Flute tool. The depth of the cut is ¼" and was done in 2 passes. The purpose was to later heat it and bend it so the piece could stand.

Taking it to the Next Level

During experimenting with CAM I thought about using the piece as display. I asked the CNC CLT if he had any ideas. He suggested that we score the bottom of the plexi and try using the heat bender to bend the plexi and making it it's own stand.



Taking it to the WaterJet

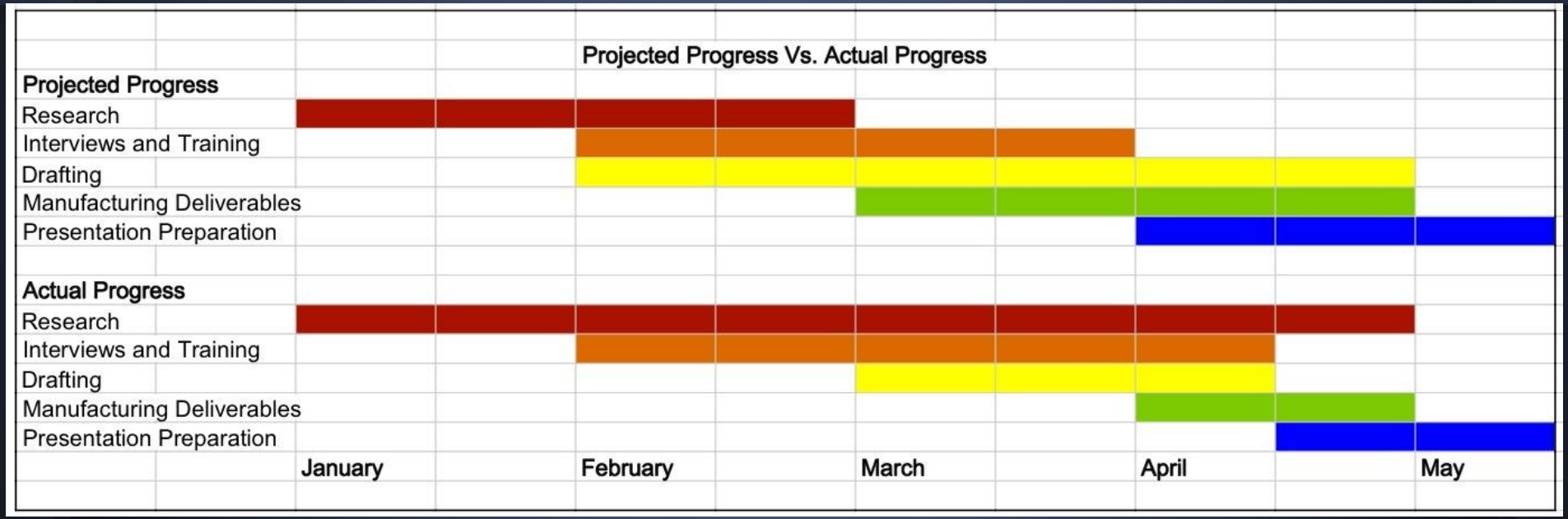
While at Showman Fabricators I also had the opportunity to work with their waterjet. Unlike a milling CNC machine the waterjet uses water pressure and sand to cut through material. The waterjet can get much more precise and leave a cleaner cut than a CNC mill. The waterjet is used to cut extremely rigid materials.

The OMAX 80160, Bed 14’ 6” X 7’ 5”, 30HP/45, 000PSI. Accuracy of up to .0135 “ (less than 1/64”)

Left. Outside right angles are cut perfectly square. Notice that inside right angles are not a perfect 90° this true for the CNC mill as well.

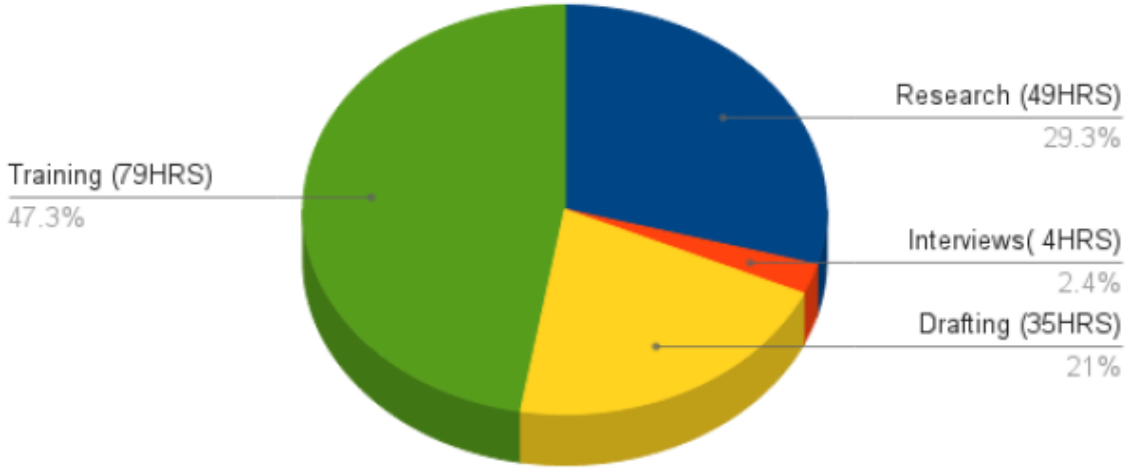
Right. The material pictured is ⅛” thick aluminum. Notice the precision and clean cuts of the shapes cut out of the metal.

Projected Progress vs. Actual Progress



Time Spent on Individual Phases

Total Hours: 167HRS



Conclusion

There are countless types of materials out there. Each material has unique properties such as thickness, density, hardness, etc. You then need to choose the proper tool(s). Tools come in as many varieties as materials do.

Therefore, in order to become an expert it may take several years. However the learning curve of CNC operation is very quick in the beginning and gratifying. You can set up a machine to cut basic 2D shapes with just 2 weeks of hands on training.

One of the most rewarding aspects of being a CNC operator is having access to the equipment that can create what to you draft. Even I don't become a professional operator I would like to someday have one in my home to use as a hobby.

Literature Cited

1. Harvey, James A. *CNC Trade Secrets: A Guide to CNC Machine Shop Practices*. Connecticut: Industrial Press Inc, 2015. Print. ISBN 978-0-8311-3502-7

2. Jat, Binit Kumar. *CNC Programing Made Easy*. 2003 New Delhi, India: Vikas Publishing House, 2009. E-book. ISBN- 13 978-8-1259-1180-7

Acknowledgments

Thank You to Showman Fabricators for allowing me to spend time in their facility. Materials in kind. Mark Riccio: Head of Engineering, James, Joe and Nick: CNC operators. Matt and Steve Grier: shop technicians Bobby Hutch: Foreman, Mark Viola: V.P

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For Further Information

Please contact *Jcorrea81@aol.com* for more information on this and related projects.

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Questions?