

User Training Manual

Roland Modela MDX-20 Milling Machine

ARC SPACESHOP



April 2013

Rev. A

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, CA

Table Of Contents

I. Introduction..... 4

II. Roland Modela MDX-20 Milling Machine..... 4

III. Safety Precautions..... 5

IV. Step-by-Step Tutorial..... 6

I. Introduction

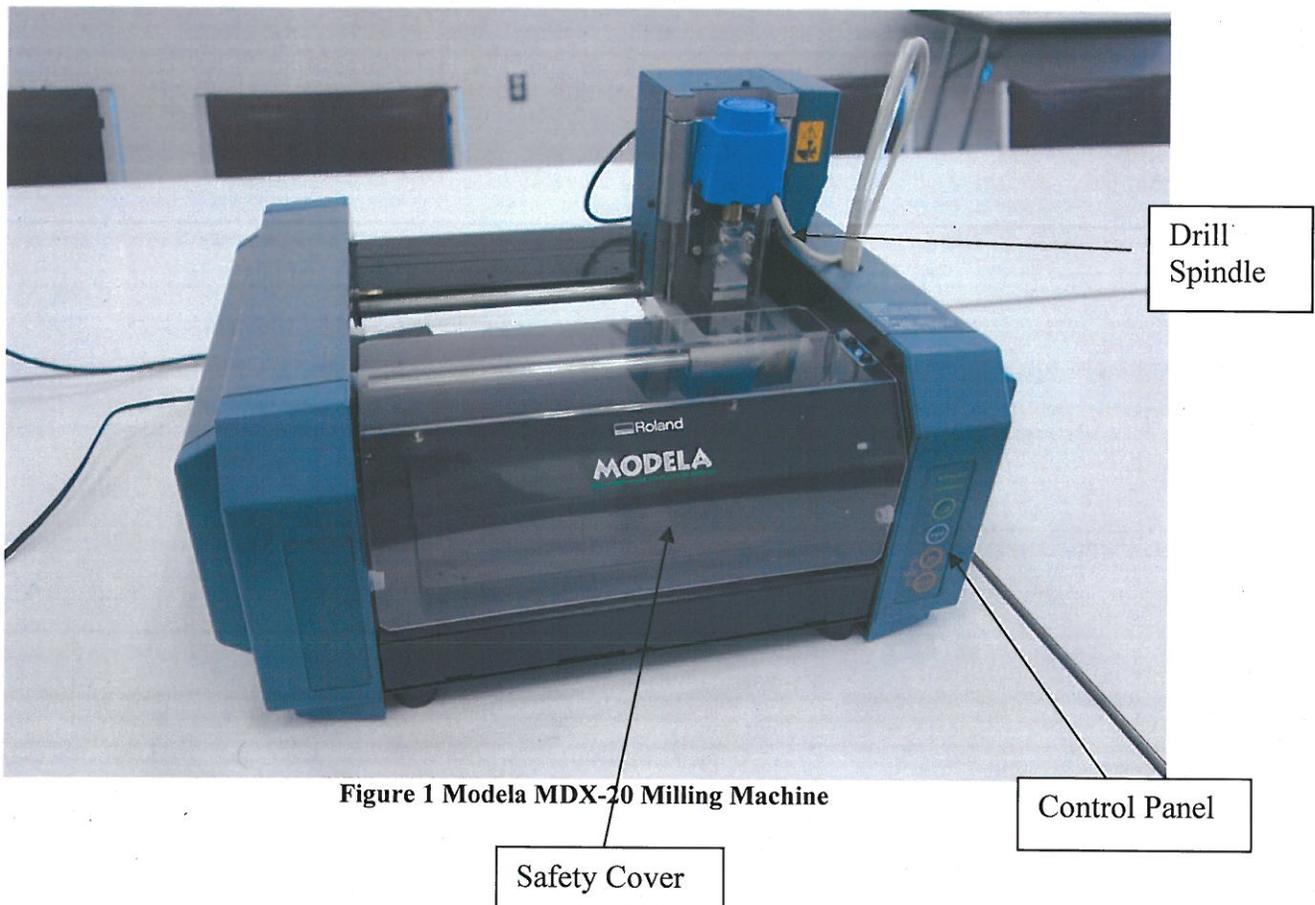
This document is for the user qualification training of the Roland Modela MDX-20 Milling Machine located at the Ames SpaceShop facility on the 2nd floor in Building 220. Before a user operates the machine, they must have signed the required documentation as described in the "SpaceShop Standard Operating Procedures". For additional information, please see a SpaceShop staff member.

II. Roland Modela MDX-20 Milling Machine

The Roland Modela MDX-20 is a desktop 3D scanning and milling machine that is compatible with many popular 3D CAD software. The machine can be used to mill ABS, acrylic, wood, plaster, styrene foam, chemical wood, wax, and light metals such as aluminum and brass. The Modela software can accept .STL, .DXF, and .MDJ file types.

Specifications:

- Maximum Working Area: 203.2 mm (X) x 152.4 mm (Y) x 60.5 mm (Z)
- Maximum Table Load Weight: 1 kg (2.2 lbs)
- Compatible Materials: ABS, acrylic, wood, plaster, styrene foam, chemical wood, wax, plaster, polyacetal, polycarbonate, Sandomur SS, aluminum, brass
- Weight of Unit: 13.7 kg (30.2 lbs)



III. Safety Precautions

a. Roland Modela MDX-20 Milling Machine Safety

SHALL...

- You **SHALL** notify SpaceShop staff prior to running any job.
- You **SHALL** wear closed-toe shoes at all times.
- You **SHALL** wear eye protection when working with tools and processes that involve chemicals, metal shards, wood chips or sawdust.
- You **SHALL** clean up your space after every job session, and leave 10-15 minutes for cleanup prior to shop closure.
- You **SHALL** secure badge and any loose items that might get caught in moving machinery.
- You **SHALL** ensure the End Mill is fastened securely inside the spindle.
- You **SHALL** ensure all tools are in good condition before use.
- You **SHALL** use your sense of sight and sound to keep yourself aware of the operational conditions of the MDX-20 for safe use.
- You **SHALL** use a brush or vacuum (will be provided) to remove the metal cuttings from the machine.

SHALL NOT...

- You **SHALL NOT** touch materials and chips being cut since they can be hot and/or sharp.
- You **SHALL NOT** wear or have any loose objects on your body while operating this machine, including badges, facial hair, jewelry, loose clothing, and loose long hair.
- You **SHALL NOT** leave a machine unattended while in operation.
- You **SHALL NOT** work alone while in the SpaceShop.
- You **SHALL NOT** use the machine with a damaged AC adapter, power cord, of power-plug or with a loose electrical outlet.
- You **SHALL NOT** modify the electrical power cord, nor subject it to excessive bends, twists, pulls, binding, or pinching, nor place any object of weight on it.
- You **SHALL NOT** touch the tip of the cutting tool with your fingers.
- You **SHALL NOT** remove the spindle unit from the carriage while the power is on.
- You **SHALL NOT** operate the machine if the transparent cover at the front of the machine is cracked or broken.
- You **SHALL NOT** place hands near the cutting tool or the probe during cutting or scanning.

IV. Step-by-Step Tutorial

a. Tools Required

- Roland Modela MDX-20 Milling Machine
- Cutting Material listed under "Specifications"
- Double-sided Tape
- Milling Bits
- Shop Vac
- Caliper to measure depth of material

b. Getting Started

1. **TAPE** the bottom of the material with double-sided tape (Figure 2).

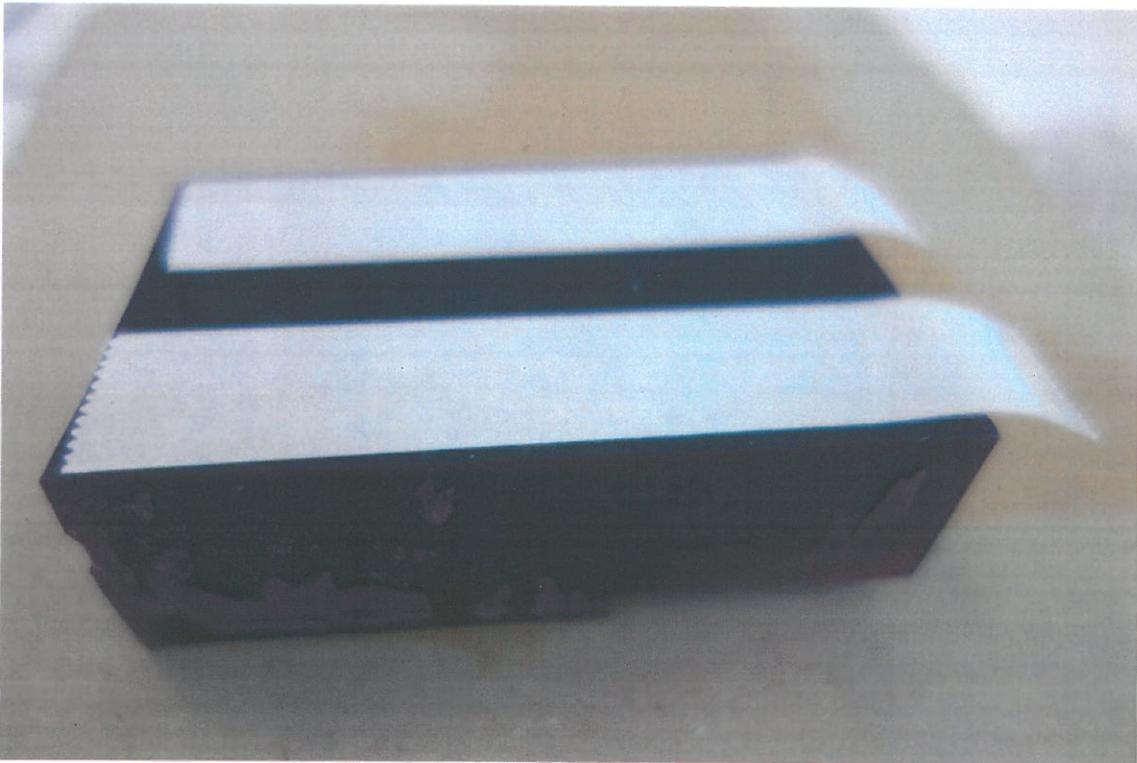


Figure 2: Material with Double-Sided Tape

2. Remove the Safety Cover (Figure 3).

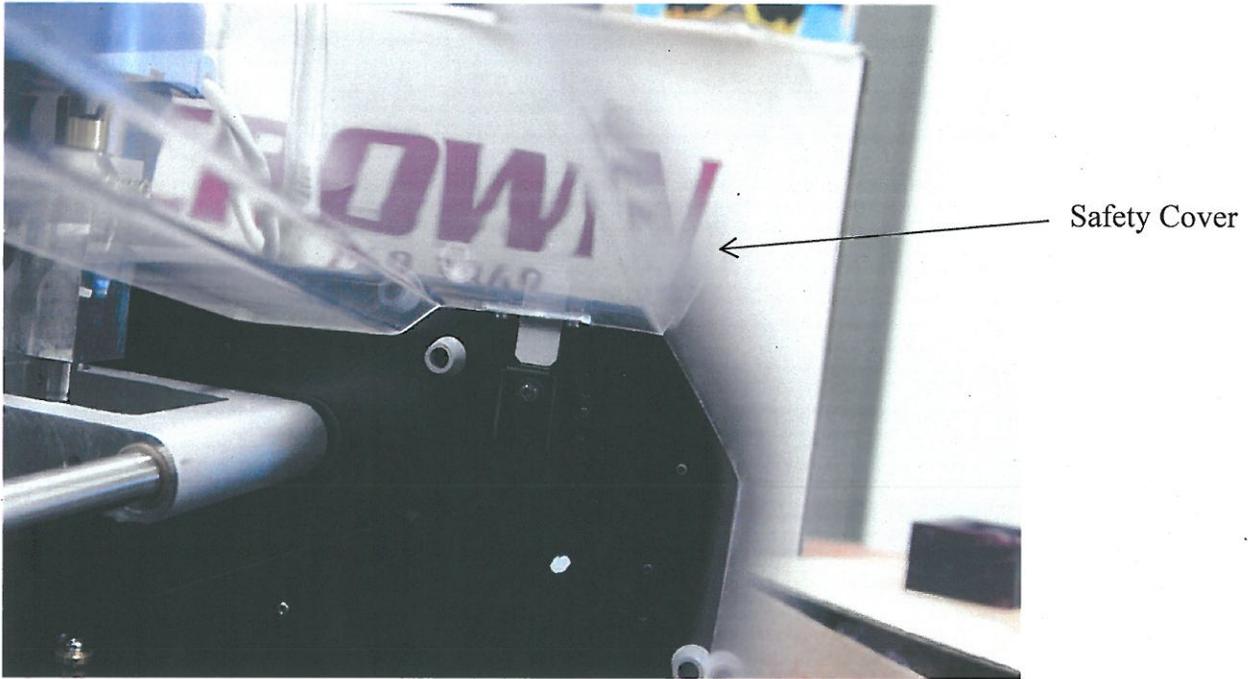


Figure 3: Safety Cover being Removed

3. Place a corner of the piece at the bottom left of the milling plate with the tape side down. Lightly push on material to ensure it does not move. If material is loose, clean material and machine before reapplying tape (Figure 4).

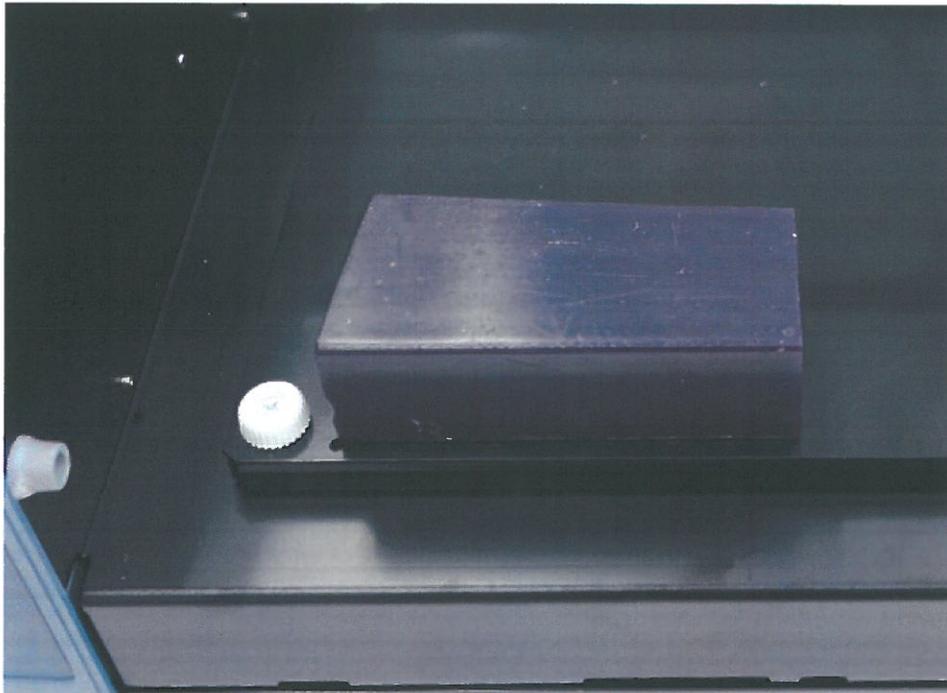


Figure 4: Material Placed in Lower Left Corner

- Put the Safety Cover back on the Modela.
- Turn the machine on by pressing the **POWER (STANDBY)** button (Figure 5).

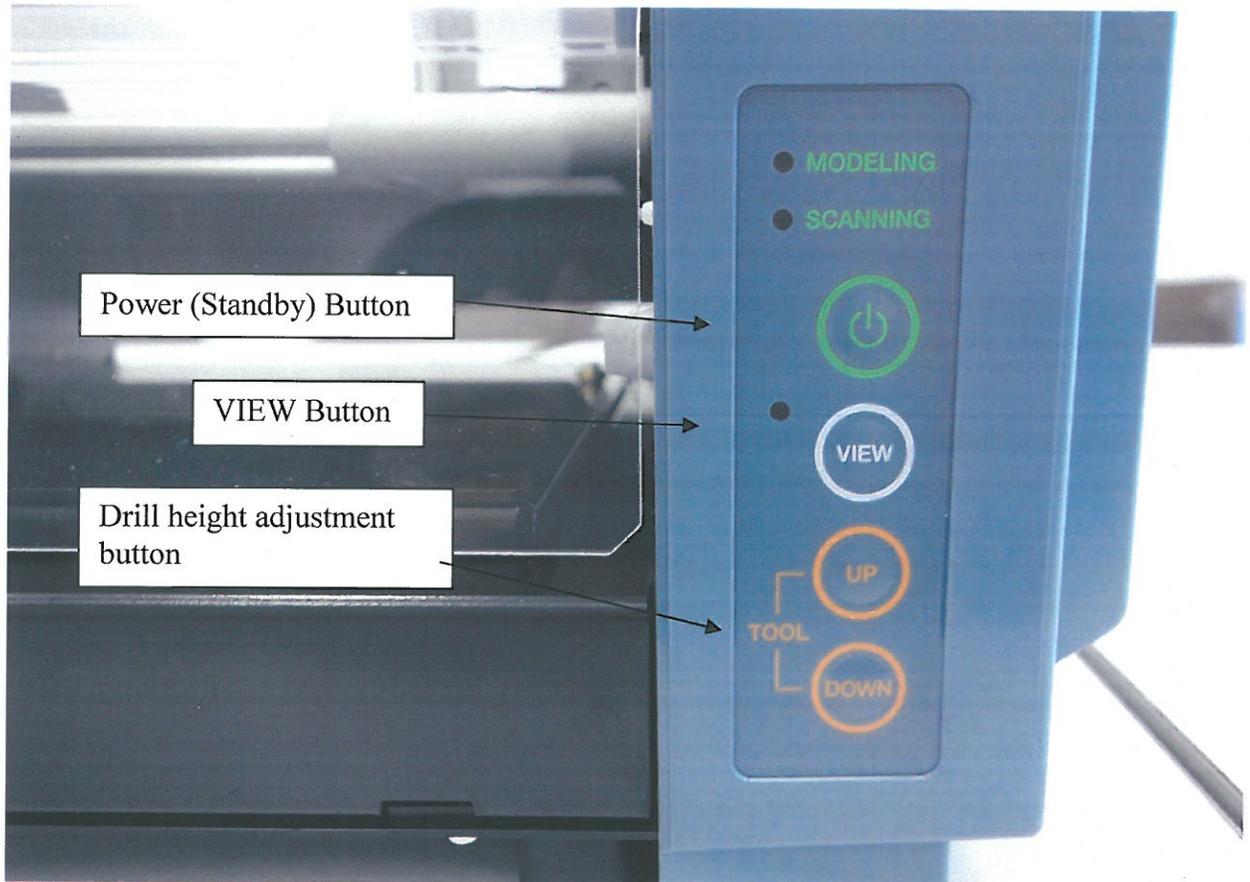


Figure 5: Machine Controls

- Press the **VIEW** button to disengage view mode.

NOTE: This button returns the platform to the middle of the machine so that cutting can begin. To view the product in the middle of a cutting job, press view to slide the platform out and press it again to return to cutting. This can be done at any time.

- Open Modela Player from the shortcut on the Desktop (Figure 6).



Figure 6: Modela Player Icon

- Go to **File–Open**, and then select your file. .STL, .DXF, or .MDJ files can be made using any 3D CAD software package (Google Sketchup, Solidworks, AutoCAD, etc.) (Figure 7).

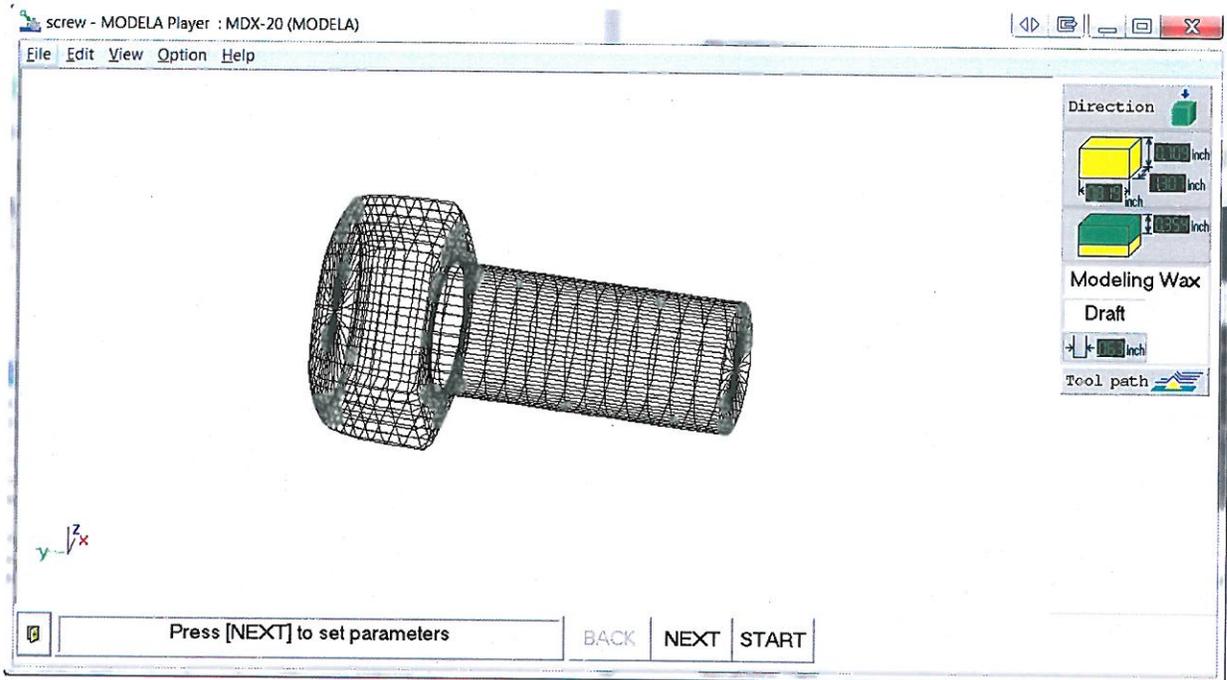


Figure 7: Main View of Modela Player

- Once the file is open, go through each item in the Settings Menu and verify that they are correct (Figure 8).

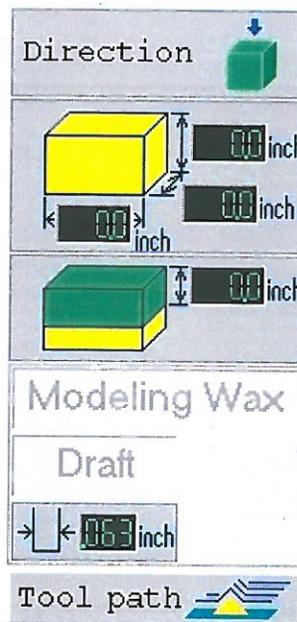


Figure 8: Settings Menu

- i. The **DIRECTION** setting should be set so that the arrow is pointed downward at the top of the object (Figure 9).

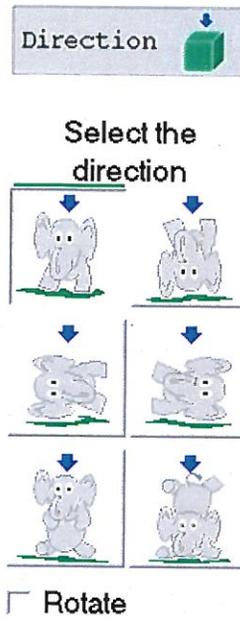


Figure 9: Image of the Settings Icon and the Direction Menu

- ii. The **SCALE** settings are for scaling of the object. Please make sure that these settings are applicable for the material area that you are cutting on (Figure 10).

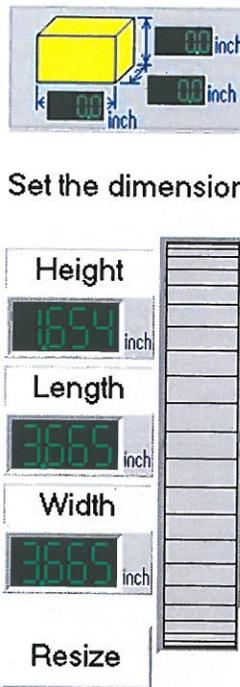


Figure 10: Image of the Set Dimension Icon and the Set Dimension Menu

- iii. The **DEPTH** settings are for the depth of the piece. If you are doing a piece that requires both sides to be cut, you can click **CENTER** and the mill will cut to the centerline of the object. If you want it all the way through, use the right scroll wheel on the screen to go all the way to the bottom (Figure 11).



Figure 11: Image of the Maximum Cutting Depth Icon and the Maximum Cutting Depth Menu

- iv. The next option is the bit settings (Figure 12).
- i. The number corresponds to the diameter of the bit. Please make sure that it is the correct diameter, either by verifying with a SpaceShop staff member or by carefully using a caliper.
 - ii. The shape of the bit can either be a ball shape or a flat shape. Make sure to verify that in the software.
- v. Select from the drop-down menu what **MATERIAL** is being cut and how the cut will be performed. Also select the finish that will be done for cutting (Figure 12).
- **DRAFT** form is the first cut of the object. This is highly recommended as this will cut the larger block of material down to what the file will look like
 - **FINE** form is the final draft of the object. This is done after the DRAFT form is complete.



Figure 12: Image of the Tool, Material, and Finish Icon and the Menu

- vi. Click the **Tool Path** Icon to create a path for the machine (Figure 13).

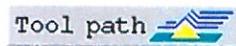


Figure 13 Image of the Tool Path Icon

10. To see a render of the model go to **File–Output Preview**. To change to a 3D view, press the **3D BUTTON** on the menu bar (Figure 14).

NOTE: If prompted to save the rendering or not, press **No**.

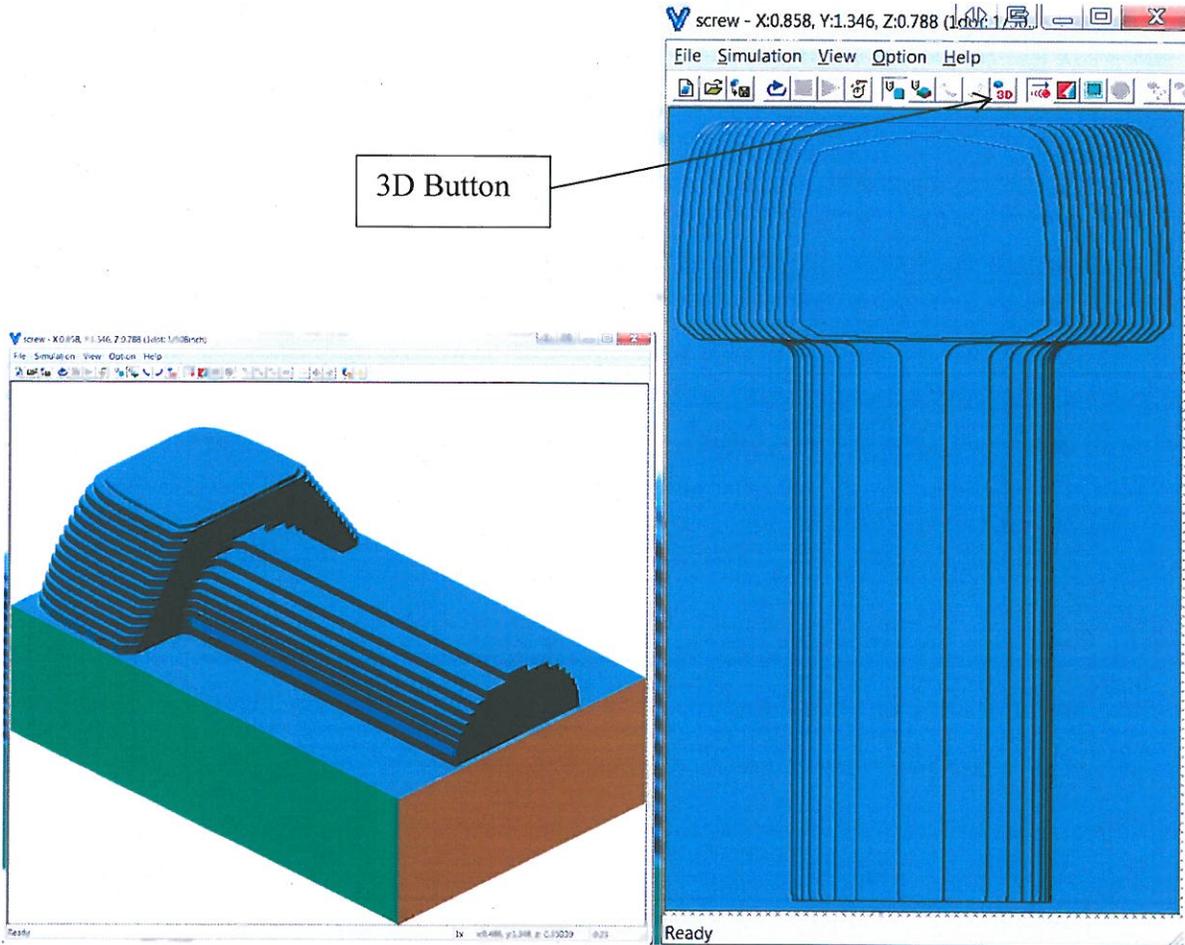


Figure 14: Rendered Images of the Milling Results

11. Go to **Simulation- Estimate Cutting Time** to see the time needed to mill the model. Press **OK** to complete this section (Figure 15).

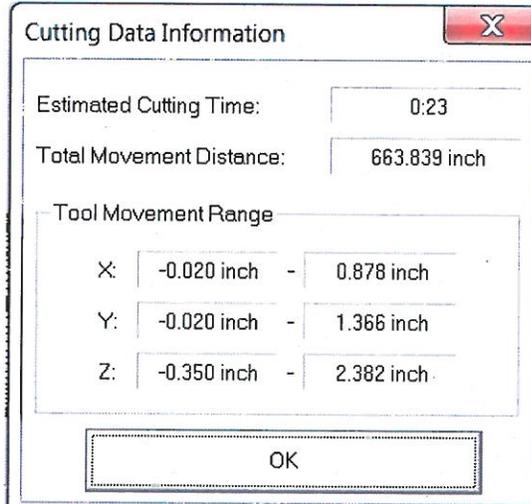


Figure 15: Cutting Data Information

Surfacing

This next section goes through the process of surfacing the material in preparation for cutting. Surfacing is the process in which we use the machine to create a flat and even surface on the material.

12. To Set a zero for the z-axis, press the **DOWN** button on the machine until the cutter just touches the surface of the material. You will want to do this slowly as you get closer to the material so as to not cut the material. Refer to Figure 4 for the down button location.
13. In the Modela Player software, go to **Option – Layout** (Figure 16).

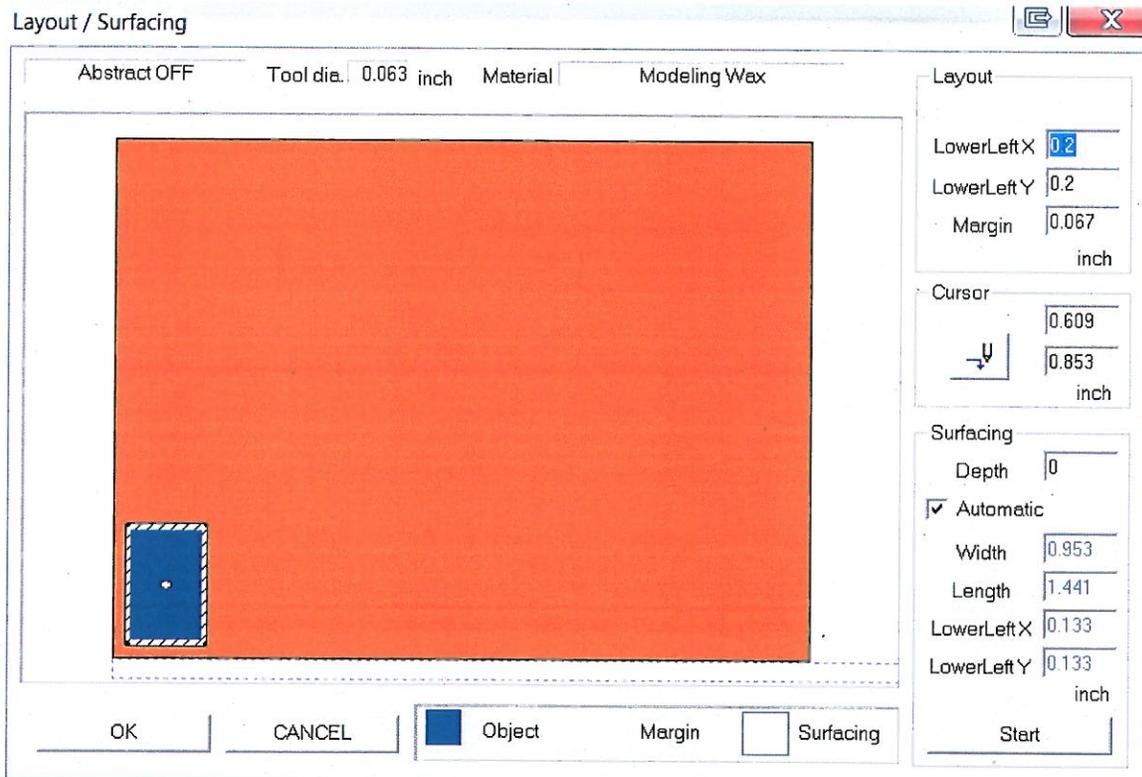


Figure 16: Layout Options

14. Set the area that you want to surface.

NOTE: The **AUTOMATIC** check box will automatically select the surface that the model will be milled on. If you would like to do custom surfacing, then unselect **AUTOMATIC** check box and manually enter in coordinates for surfacing.

15. Set the surfacing depth to 0.02 inches.
16. To verify the selected area to surface, double click the black dots at the **CORNERS** of the **BLUE AREA** to move the bit head to those locations. The yellow dot is used to move the drill to any point. Drag and double click to use.

17. Once the settings have been verified, click **START** on the “Layout/Surfacing” window. This will start surfacing the material (Figure 17).

CAUTION: DO NOT remove the cover while in process as this will reset the printing task.

NOTE: If you would like to stop the surfacing for viewing, press **VIEW** on the Milling Machine Panel to reset the milling head to the starting position and then remove the protective cover. Once you are done viewing, put the protective cover back on and then press **VIEW**.

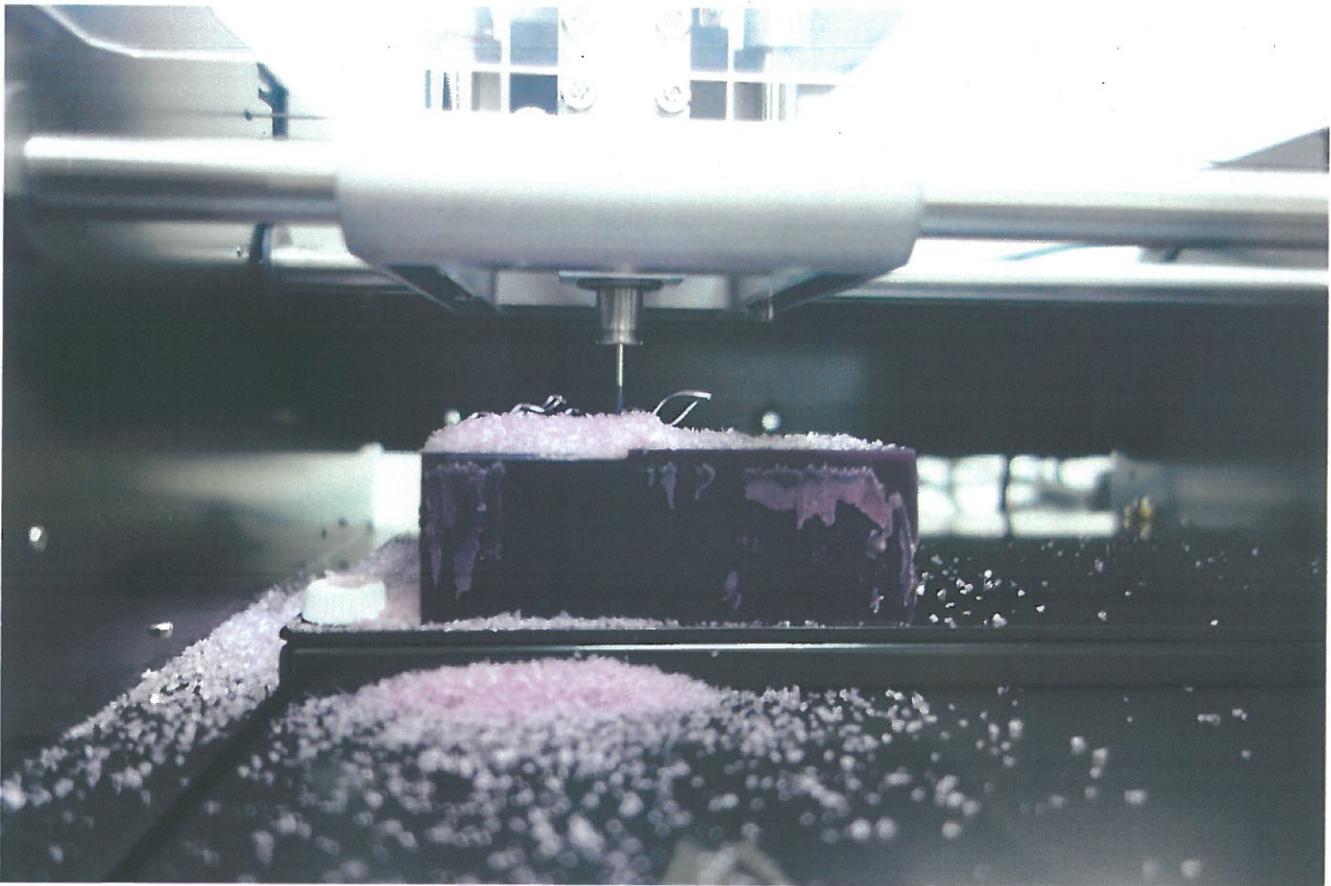


Figure 17: Modela MDX-20 Performing Surfacing Operation

18. Press **OK** after surfacing is complete.

NOTE: Make sure you do not close the **LAYOUT** window without pressing OK or the changes you made to the position of the model will not be saved.

Cutting

This section goes through the process of the actual milling (or cutting) of the material.

19. Press the **START** button located at the bottom of the screen. This first run should be the **DRAFT** run (Figure 18).

NOTE: This will begin the milling process of your part. Milling can be paused at any time by pressing the **VIEW** button to bring the model out. You can also clean the shavings from the model at this time by using a vacuum. A Shop Vac is provided for this purpose.

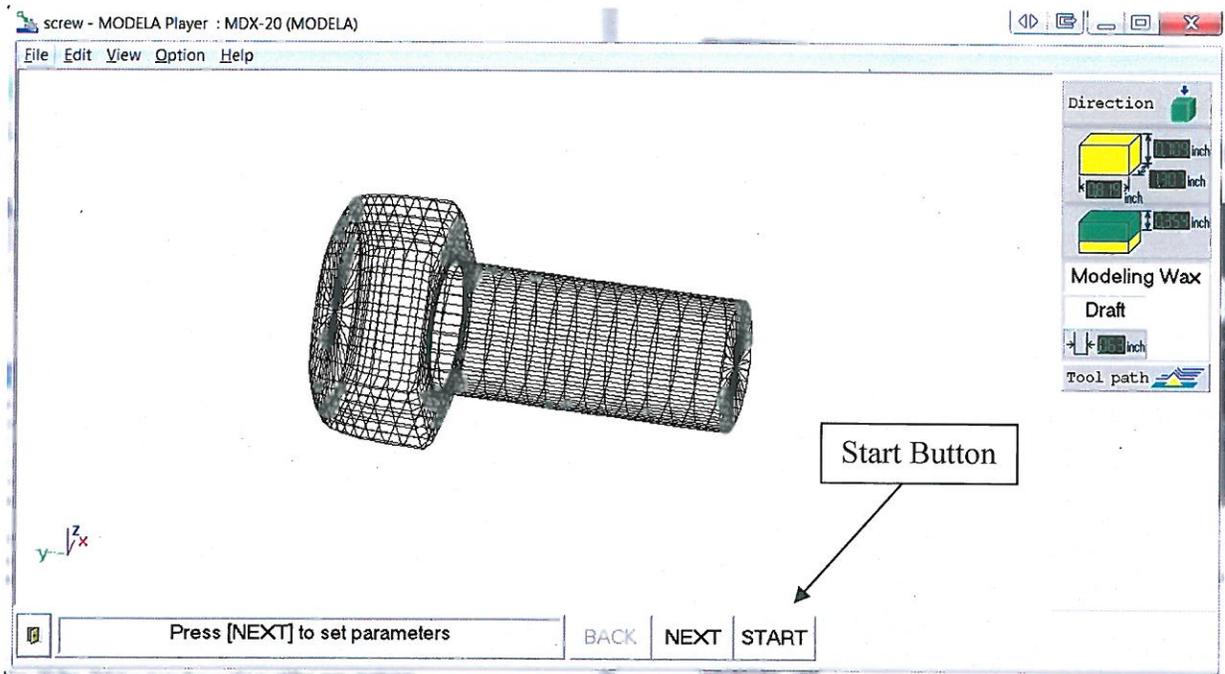


Figure 18: Model Player Interface

20. Once complete, verify that the draft looks similar to the Draft view on the Virtual Modela screen. Change the Finish to **FINE** and press **START** again. Rendering again and estimating the time is also possible during this stage.
21. Once the product is complete, Press **VIEW** to move the spindle back to the start position.
22. Clean up using the Shop Vac.
23. Remove piece from plate carefully. Do not use a screwdriver or another tool as this may scratch the mill table.
24. Congratulations! You have successfully completed the Roland Modela MDX-20 Milling Machine Training!

Advanced Tips

- To do both sides of a object, it may be necessary to add a tab to hold the object in place while milling.
- Make sure to vaccum the area around the object once complete, and if you need to see the object during the cutting process, press **VIEW** on the machine, vacuum the area where the part is, and then click **VIEW** again to continue milling.
- Do not remove cover while printing because all memory may be lost. If you need to remove the cover for any reason, press the **VIEW** button, wait until the milling head has stopped moving, then remove the cover. Make sure to put back the cover before you continue milling.