Seraph Model 3 Printer Software User Guide

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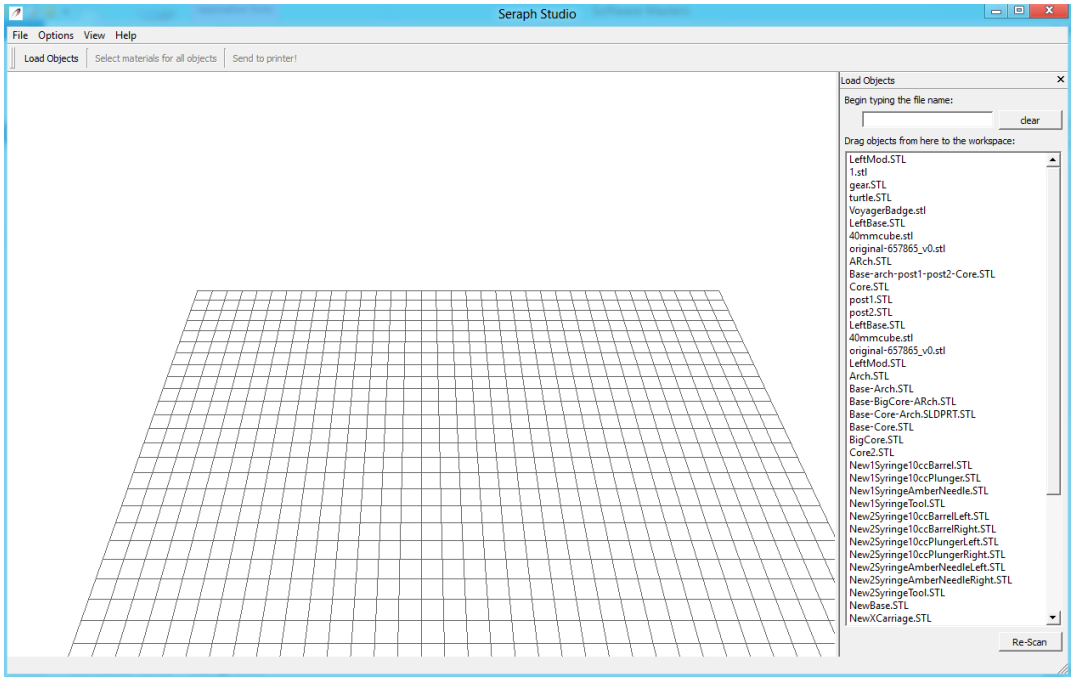
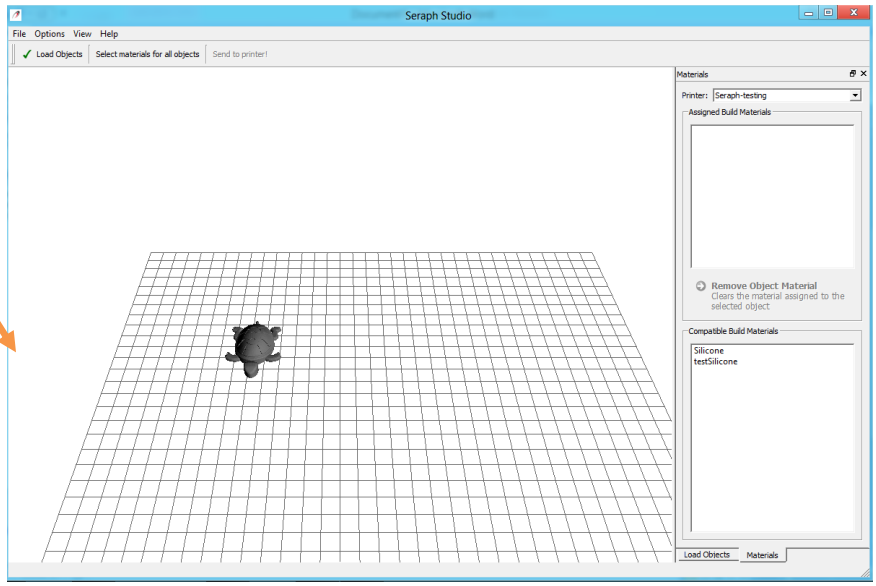
SeraphStudio

Load Objects

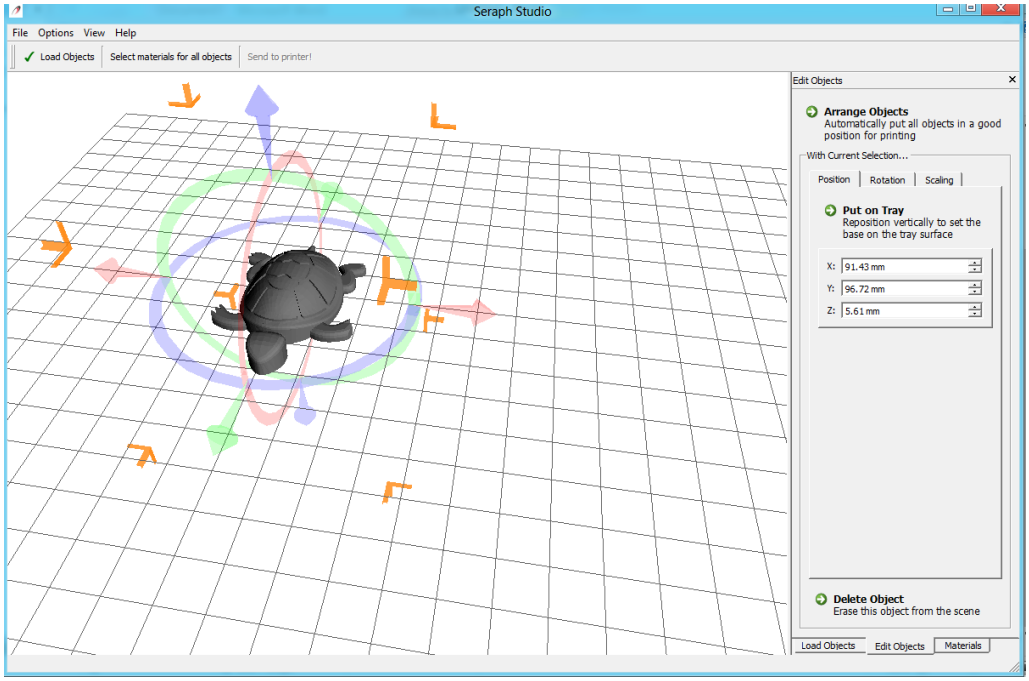


Upon opening Seraph Studio the program searches your User directory for all STLS and places them in the load objects box



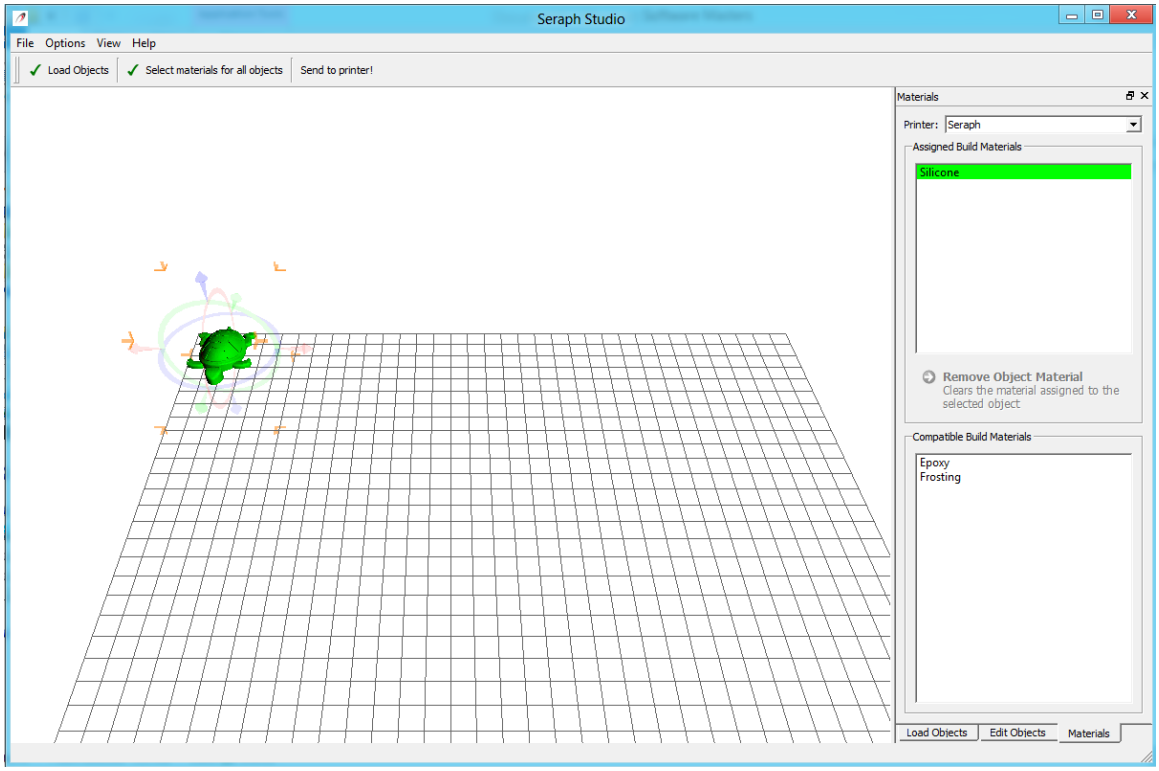
Drag and drop the design into the scene it will appear along with the graphic controls. Dragging and object into the scene will cause the program to switch to the “select material” state, and the materials list will appear. The arrow points to the origin of the scene. You can zoom by holding down the right click button and moving the mouse forward and backward. To rotate views, right click and move the mouse left and right

Edit Objects



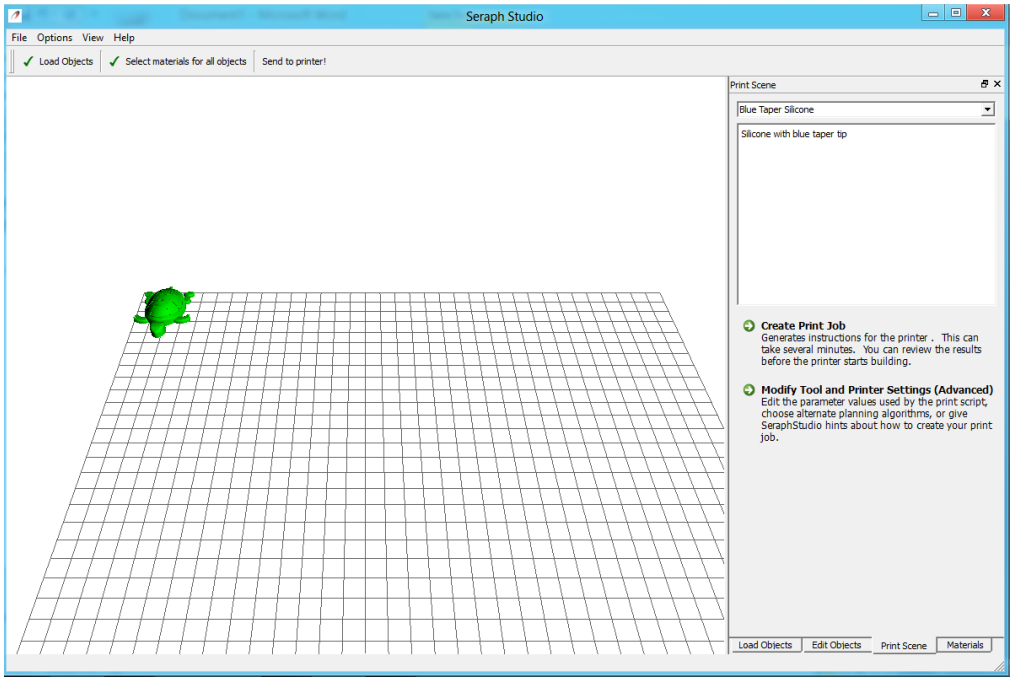
The rings on the visual control allow you to rotate the object by 90 degree increments. The arrows allow you to move the object; the corner markers allow you to scale the object. When you grab the object it will bring the edit objects tab up.

Select Materials

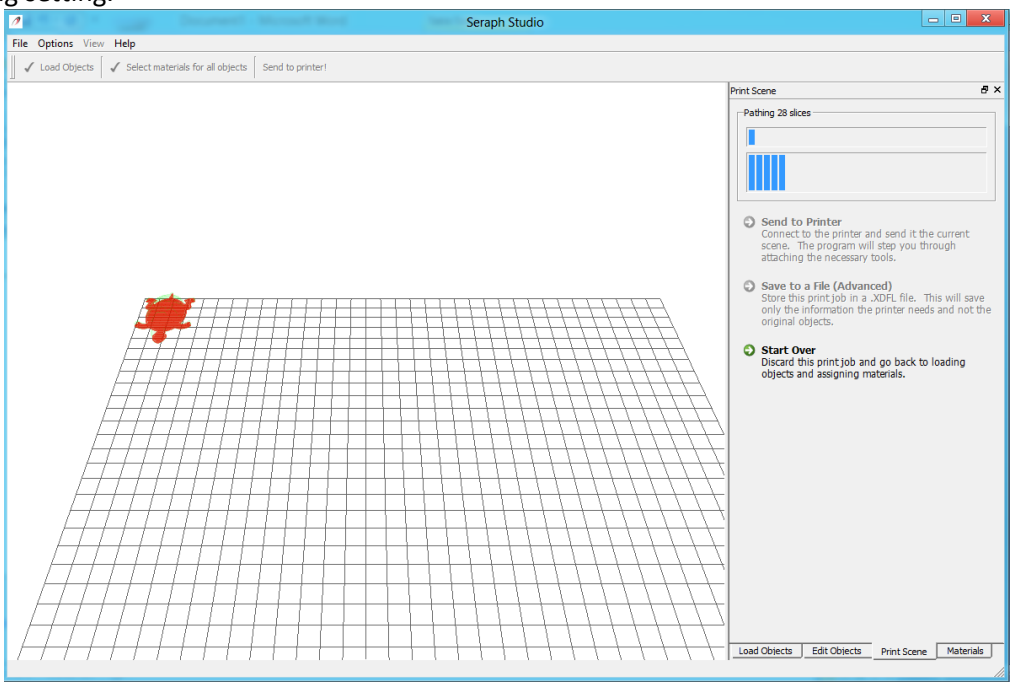


To load a material, click the material tab or Select Material breadcrumb. Use the dropdown to select the type of tool head and printer you're using to filter the material options. Drag and drop the material to the object. This will cause the object to colorize. It will also allow you to see what other materials can be printed with the selected material.

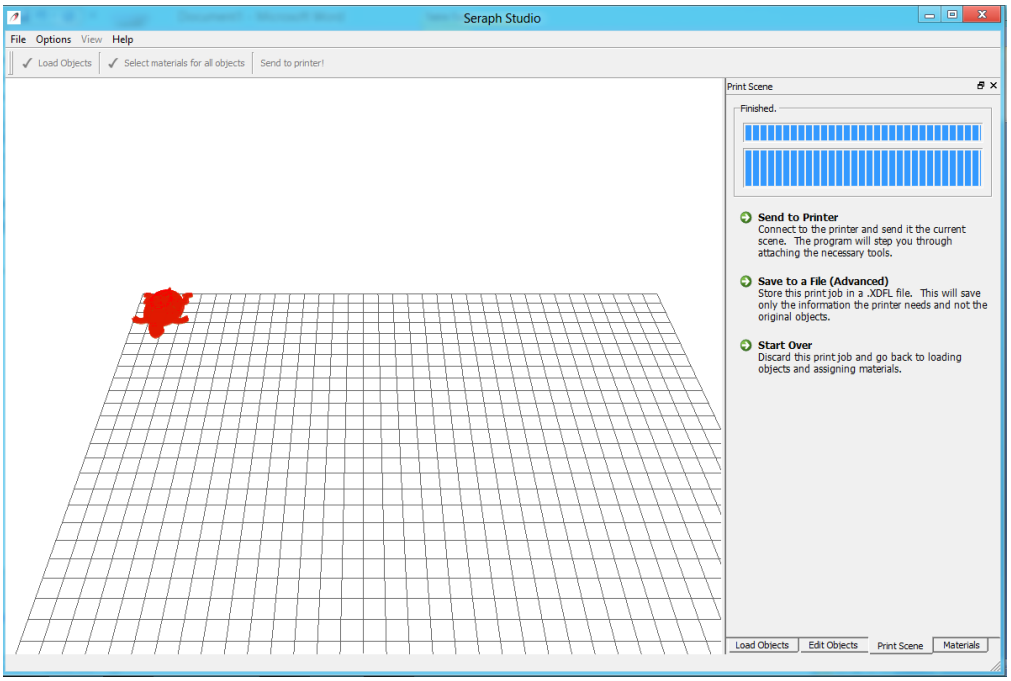
Generate Print Job



Hit Send To printer to bring up the bring screen tab. This will allow you to set the resolution and other settings by selecting the script form the drop down menu. You can then create the print job or modify the pathing setting.

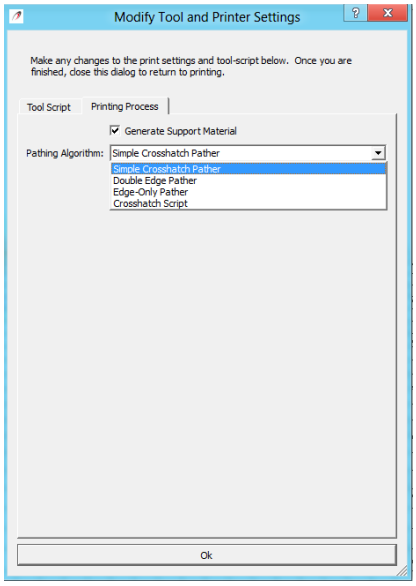


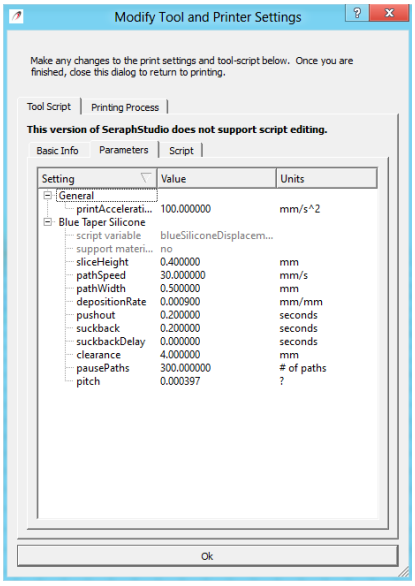
When the hit create print job, the system will slice and path the object. This will cause it to path the object. Paths show up as red lines.



Once pathed, you can either send it to the printer, or save to a file. We recommend saving the print for later. If you don't see the save to file option, please enable advanced features under options
Congrats, you have made your first print job.
Once saved you will need to use SeraphPrint to control the printer.

ADV features

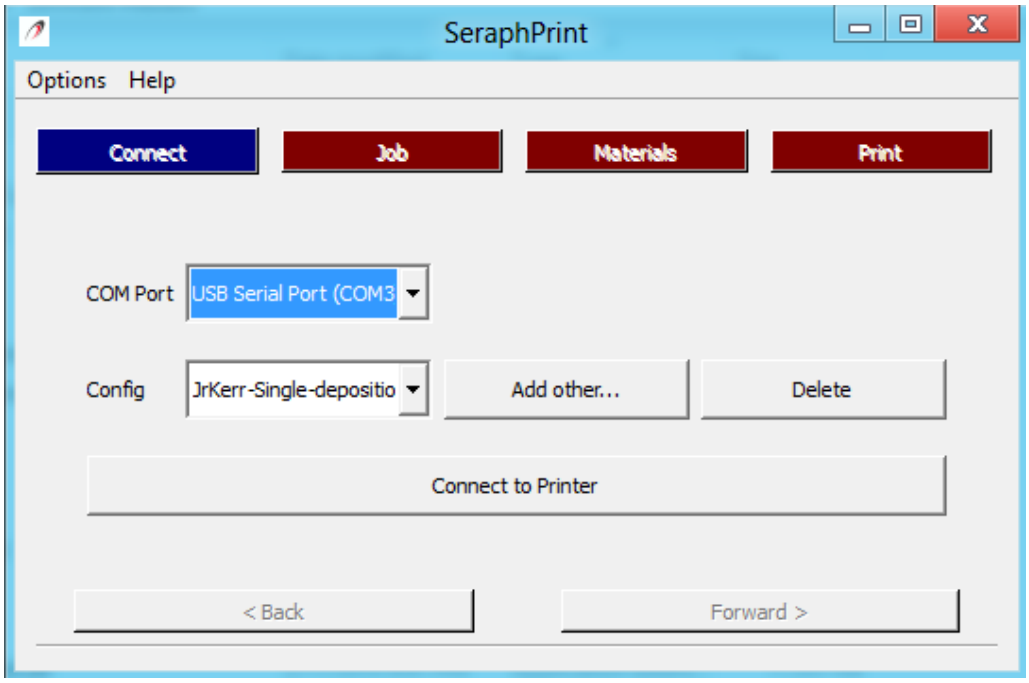




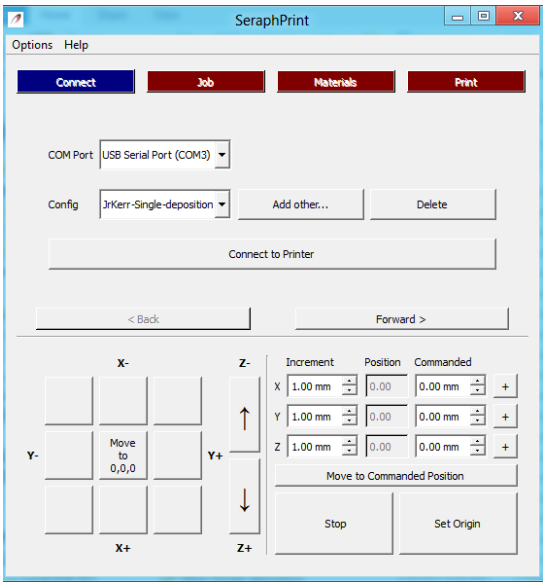
The modify tool and printer settings allows you to select the pather used and if support material is generated. The edge pathers create outlines of the object. Simple Crosshatch script generates an object with double walls and a crosshatch. The crosshatch script only uses a crosshatch to fill the object. You can also review the settings of the toolscript.

Seraph Print

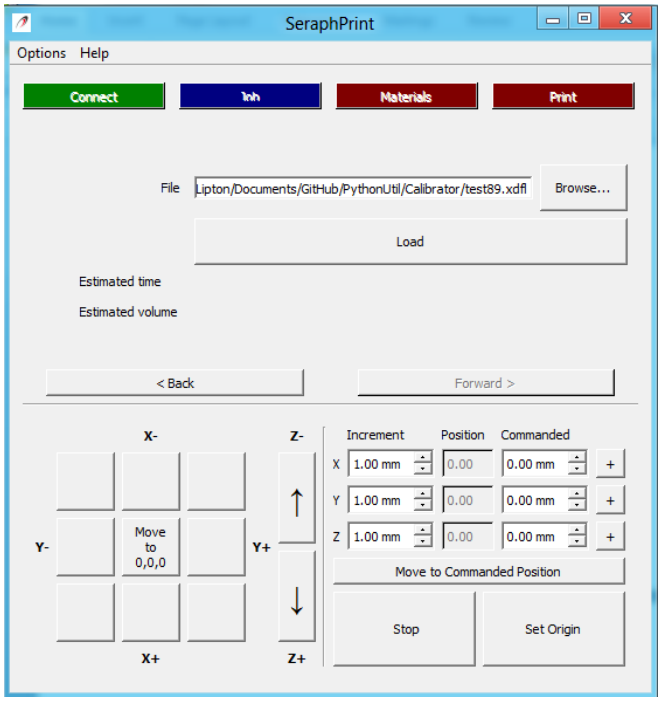
Connect to printer



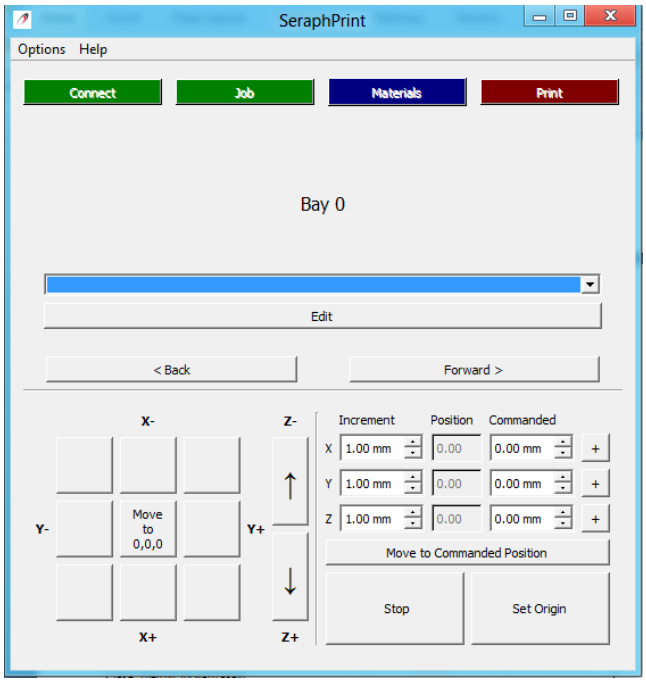
Open Seraph Print. It will load into the connect state, Here you will see a dropdown list of ever available machine. The comport of the machine will be listed. You will need to have the FTDI VCP drivers installed for your operating system. The list of previously added configs will also be available. If you don't see any configs, hit add other to find a printer config file. If you cant see a comport, make sure that the hub is plugged in an turned on, and that the drivers are installed. Once you have selected the machine and config, hit connect to printer. Should it fail to respond after 3 seconds. Cycle the power of the printer and relaunch the program.



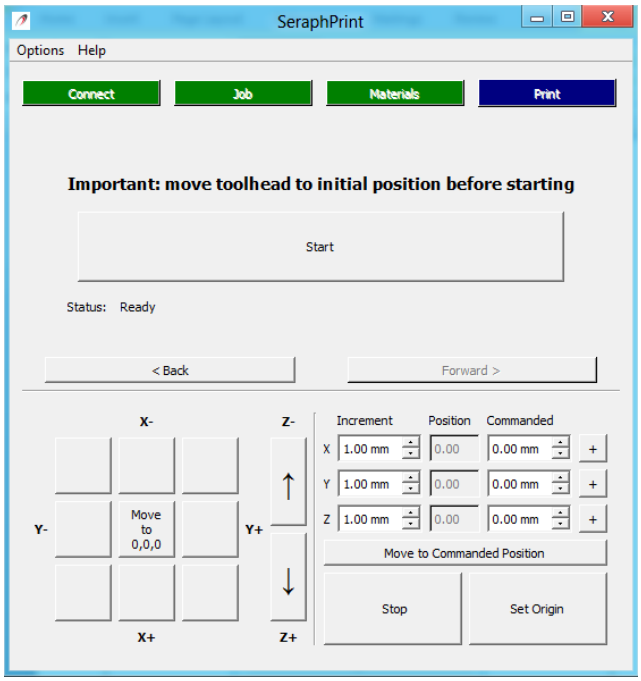
Once connected, the machine interface should appear. You can use the arrows plus up page and down page to jog the head. You can adjust the jog increment, and hit the plus arrow to adjust the speed



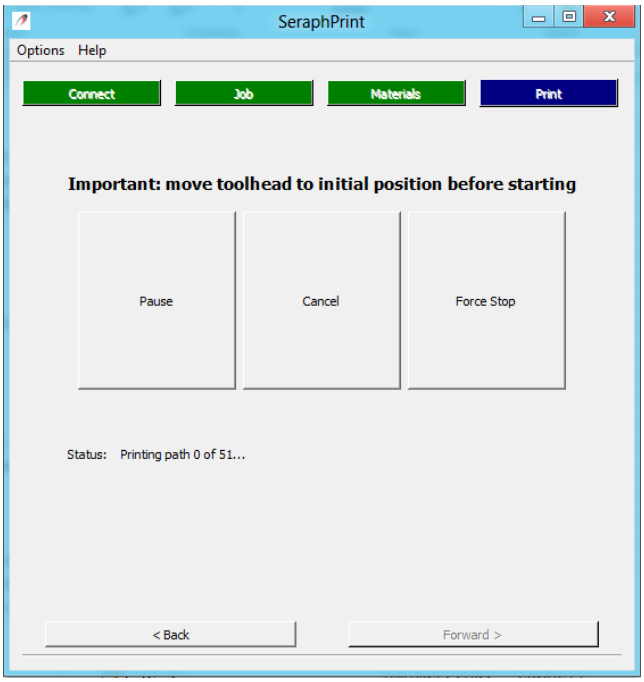
Hit forward and you are brought to the load file stage. You can load the last file by hitting load, or you can browse for the print file. Once loaded you will be given and estimate on how long the print should take. Then hit forward again.



In the materials stagem you can select which print material In the job is in which bay. You can jog the bay motor by hitting edit and using the popup dialog. Once the material is loaded hit forward



Before you start to print, job the print head so that the tip of the bay just touches the build surface. Once there, hit Set Origin. This will set that location as 0,0,0 for the print job. Hit start and the print will begin



Once the print is started you can pause, cancel or forcible stop the print. IF you forcibly stop the print, the program will crash and the machine will freeze. Only use this for emergencies. Pausing will cause the machine to finish the current path and then wait for your instruction to resume. Canceling will finish the path and quit printing, returning you to the load file stage.

Calibrating a new material

All new materials will need to be calibrated for the size fo the nozzle used, the materials properties, and sometimes different environmental factors. It is important to keep in mind how the printer operates when calibrating a material. The printer lays down a bead that can thought of as having a height (PathHeight Ph) a width (PathWidth Pw) and a length D. This is done in a set time t.

Since $Volume = Width * Height * Distance * constant$ for extruded prisms. We can write an equation $Q = \frac{Vol}{t} = A_c * P_w * P_h * \frac{d}{t} = A_c * P_w * P_h * P_s$ where $P_s$is the path speed. Ideally the tool head would balance out this mass flow equation and deliver the exact amount of material as needed. However printed materials often have non-linear fluid properties and can be compressible. Therefore we need a "Compression Volume" term that can account for the need of the print head to charge up at the beginning of a deposition and decompress at the end. General the path width and height are measured imperially for a material flow rate and nozzle size. Often the dimensions are very close to the nozzle diameter. From there you can calculate the volume per unit length of material and get the Area Constant. Then you fix the path speed to match the flow rate you had established. This may require some iteration to get right. To add the calibration to Seraph Studio you will need the following steps:

1) Copy and rename a tool file.
2) Edit the tool file to have the new values
3) Rename the script variable and material names
4) Save the tool file
5) Launch Seraph Studio.

We prefer notepad++ on windows for editing tool files.

```
<toolScript name="Blue Taper Silicone"
            description="Silicone with blue taper tip"
            printer="Seraph">
```

The tool script has a name, description and is linked to a printer config. The name is what is shown in the dropdown menu and should be a short but accurate description. The description is a space for a longer winded description of the toolscript.

```
<settings>
  <!-- Settings that are not per-tool -->
  <printAcceleration text="Print Acceleration" units="mm/s^2">100</printAcceleration>
</settings>

 <!-- Expose settings for the first tool -->
 <tool name="Blue Taper Silicone" material="Silicone" scriptVariable="blueSiliconeDisplacement">
   <settings>
     <sliceHeight text="Slice Height" units="mm">0.4</sliceHeight>
     <!--Top speed in millimeters/second for this tool during execution of path.-->
       <pathSpeed text="Path Speed" units="mm/s">30</pathSpeed>
     <!--Width of the path in millimeters.-->
       <pathWidth text="Path Width" units="mm">0.5</pathWidth>
     <!--(millimeters of plunger motion)/(millimeters tool travel) along deposition path.-->
       <depositionRate text="DepositionRate" units="mm/mm">0.0009</depositionRate>
     <!--Seconds of early dispensing to start flow quickly.-->
       <pushout text="Pushout" units="seconds">0.2</pushout>
     <!--Seconds reverse plunger motion to stop flow quickly.-->
       <suckback text="Suckback" units="seconds">0.2</suckback>
     <!--Seconds to delay suckback by.-->
       <suckbackDelay text="Suckback Delay" units="seconds">0</suckbackDelay>
     <!--Millimeters of clearance between tip and last layer when traversing.-->
       <clearance text="Clearance" units="mm">4</clearance>
     <!--Number of paths after which to trigger an automatic pause.-->
       <pausePaths text="Pause after # Paths" units="# of paths">300</pausePaths>
     <!--no comment-->
       <pitch text="Pitch" units="?">0.000397</pitch>
   </settings>
 </tool>
```

There are two types of settings, global and material specific. You can have an infinite number of materials in a print; you just need to have enough <tool> sections and an accurate printscript (see later down). Here is where you edit the Path properties. Ignore all of the settings other than the path width slice height, and path speed. You will need to rename the script variable for the material. Every material calibration in every tool file must have a unique script Variable.

```
<![CDATA[
function makeCalib(x){
  x.CompressionVolume = (x.pushout+x.suckback)*.5*5000*x.pitch;
  x.AreaConstant  = x.depositionRate*3.14159265*64/x.sliceHeight/x.pathWidth;

  y={pathSpeed: x.pathSpeed,
     pathHeight: x.sliceHeight,
     pathWidth: x.pathWidth,
     areaConstant: x.AreaConstant,
     compressionVolume: x.CompressionVolume
    }
  return y;
}

progress.setSteps(blueSiliconeDisplacement.meshes.length*2 + 4);

slicer.setSliceHeight(blueSiliconeDisplacement.sliceHeight);
pather.set("PathWidth", blueSiliconeDisplacement.pathWidth);
for (var i = 0; i < blueSiliconeDisplacement.meshes.length; ++i) {
  progress.log("Slicing Silicone Mesh");
  slicer.doSlicing(blueSiliconeDisplacement.meshes[i]);
  progress.step();
  progress.log("Pathing Silicone Mesh");
  pather.doPathing(blueSiliconeDisplacement.meshes[i]);
  progress.step();
}

var blueSiliconeDisplacementMaterialCalibration = makeCalib(blueSiliconeDisplacement);

var fabWriter = fabFile.fabAtHomeModel2Writer();

fabWriter.addMeshes("blueSiliconeDisplacement", blueSiliconeDisplacementMaterialCalibration, blueSiliconeDisplacement.meshes);
progress.step();

fabWriter.sortBottomUp();
fabWriter.setPrintAcceleration(printAcceleration);

progress.step();
fabWriter.print();

progress.finish();
]]>
```

The printscript is a series of commands writing in JavaScript to control how the object is pathed. You should only edit this if you are adding materials or changing the script Variable. You can hard code the area constant in the makeCalib function. If you want to add a material, Copy every command that uses the original script Variable command and paste it in with the new materials script variable.

Good luck calibrating materials! And have fun printing.