How to Estimate 3D Print Time of a Part

for SolidWorks 2014/2016 and CatalystEX 4.4

by Matt Gerber
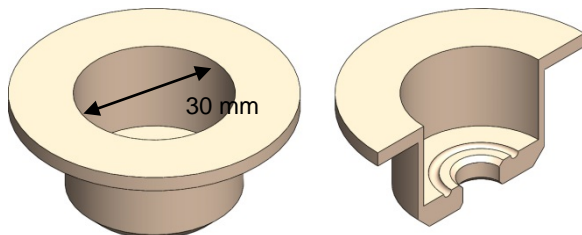*http://www.maclab.seas.ucla.edu/people/matt-gerber/*
gerber211@g.ucla.edu

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The overall process is:
1. In SolidWorks, save part as STL file
2. In Catalyst, load STL file, change orientation, and load into print "pack"

This tutorial uses the following part as an example:

This is a cup to secure a pig eyeball during surgery. It's a good part to print because (1) it'd be difficult to machine and (2) it's intended to be single-use and disposable to decrease post-surgery clean-up time. More information regarding this research can be found here: maclab.seas.ucla.edu/research/iriss-3/

Once satisfied with your part's design, save the part as an STL file. In SolidWorks, click **File → Save As...** and in the pop-up window, under **Save as type**, select **STL (*.stl)**
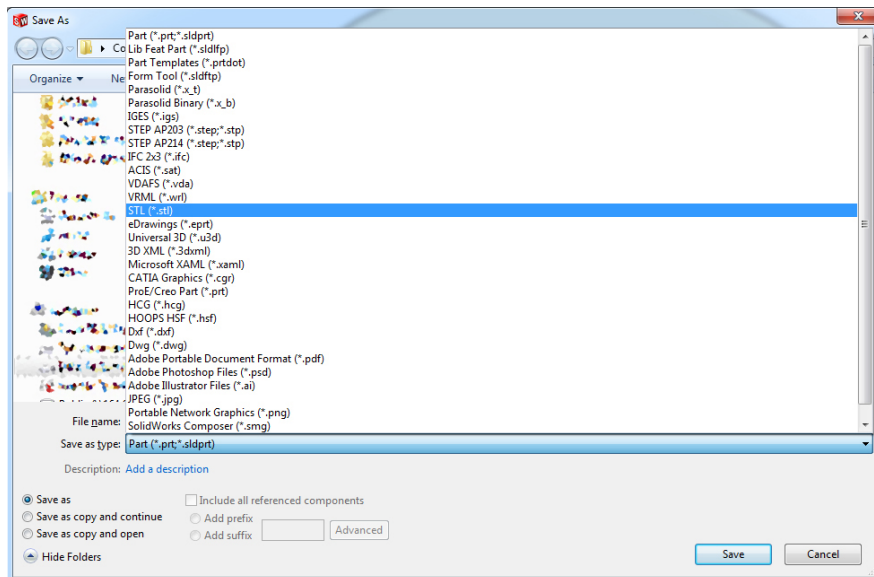
Before clicking **Save**, click the **Options...** button near the bottom of the window.

In the pop-up window, increase (move to the right) the sliders for **Deviation** and **Angle**. In essence, this makes a "higher resolution" part; i.e., round features will appear rounder; angles will be more accurate.
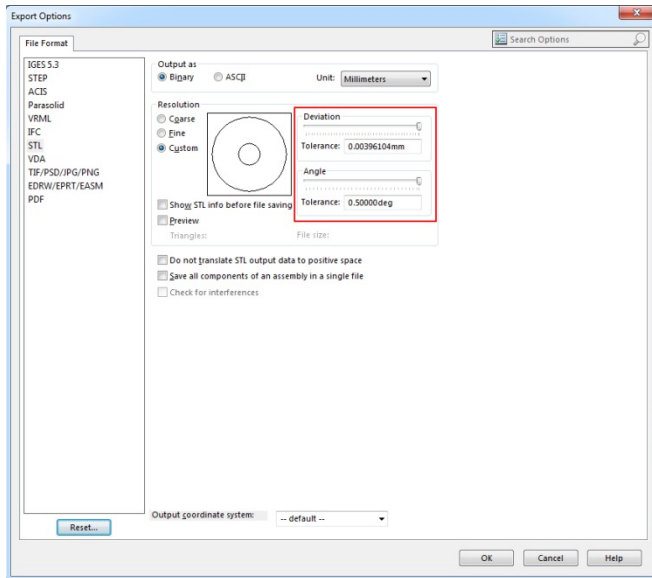

Units will default to the part file settings. Generally, leave as is.

Next, open the 3D printer software, **CatalystEX 4.4**. In Catalyst, open the STL file you just created, **File → Open STL...**

Common Issue: Depending on (1) the size of your part, (2) the default dimensions in Catalyst, and (3) the dimensions you saved the STL file as, you may get one of the following two pop-ups:
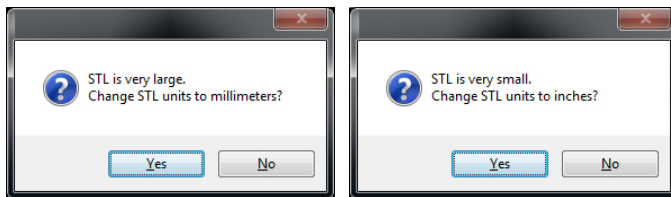
Typically, just click **Yes** and see what it does. In our example, this has done something horrible:
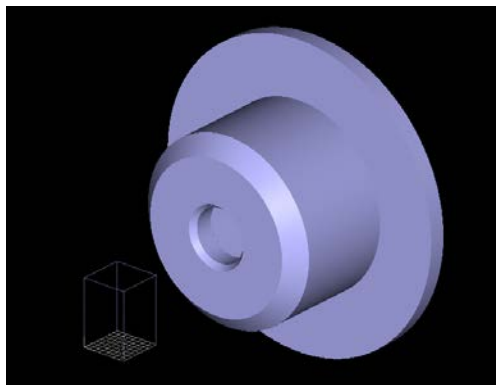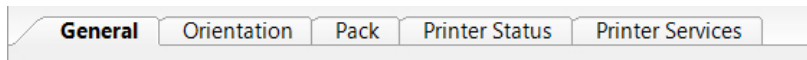
The wire-frame grid and volume (bottom-left of the image) represents the 3D print volume inside the 3D printer—the grid forms a pattern of 1-inch squares. The software has incorrectly scaled the part. To fix this, change **STL Units** (on the right) to "Millimeters." Do NOT change the value of **STL Scale**.
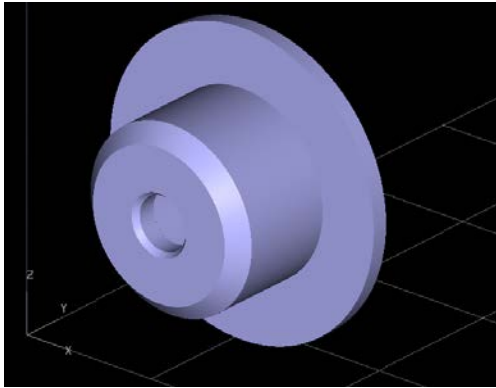
The diameter of the cup is 30 mm and each square of the grid has an edge 1 inch, so this looks correct.

Navigate the Catalyst software with the tabs at the top. The remainder of this tutorial is divided into three sections: **General Tab**, **Orientation Tab**, and **Pack Tab**.

General Tab

Under **Properties** (on the right), the following can be changed:

Layer resolution: *0.01 or 0.007 inches*
Using 0.007 will produce a more accurate part, but will add print time.

Model interior:
Sparse – low density:
Lightweight and very brittle; Quickest print time option. Do not use if you have tapped holes.
Solid:
Longest print time option. Best option if part has tapped holes, especially small ones.
Sparse – high density:
A good trade-off between the other two options. Can use for larger tapped holes.

Support fill: Leave as **SMART**.

Number of copies: How many copies of this specific part do you want? Can be changed later in the Pack Tab.

STL scale: Leave as 1.0

Note: The properties you choose here are for the entire pack—*not* a specific part.

Orientation Tab

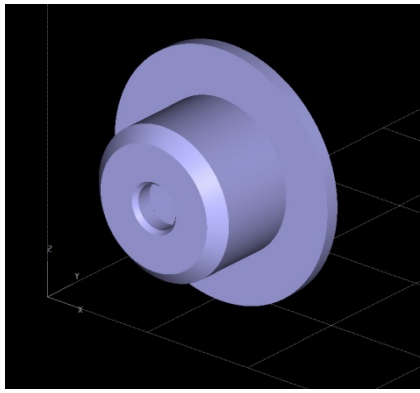Use the options here to change the part's orientation. You want to consider three things:
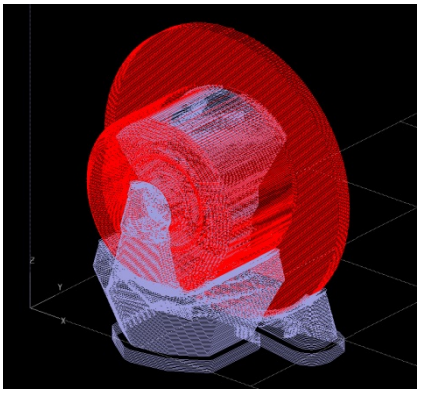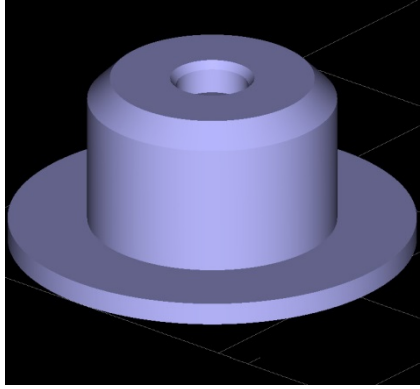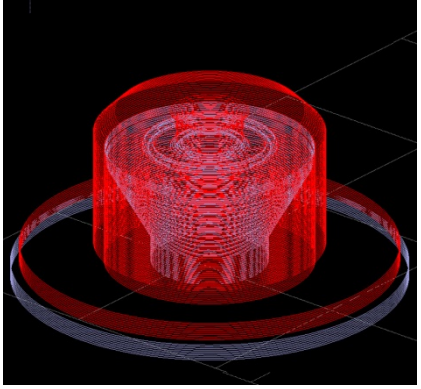
1. Amount of support material required
2. Shear planes of the part geometry
3. Orientation of holes or other circular features

Consideration 1: Amount of Required Support Material
The amount of required support material depends on the part's orientation and will directly affect the amount of required print time. More support material = longer print time.

To determine the amount of required support material for an orientation, click the **Process STL** button at the bottom of the window. This calculates the print paths for the part and provides a visual preview.

The difference between two possible orientations is illustrated in the following table:

Part File	Processed Part File	Estimated Print Time [h:min]
		2:21
		1:13

The second orientation saves approximately 1 hour of print time. Obviously, orientation is an important consideration.

Consideration 2: Shear Planes
When 3D-printed parts fail, they fail along the planes put down by the printing process. These planes should not be orientated in line with planes of significant shear stress in your part (based on intuition or simulation).

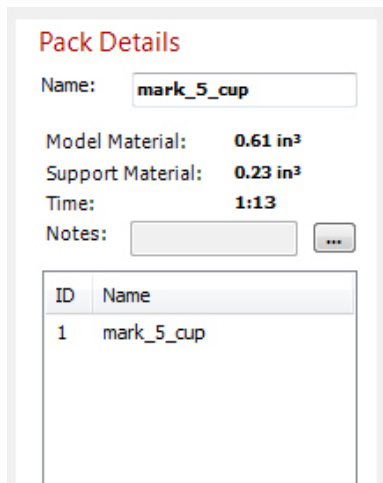**Consideration 3: Circular Features**
Circular features printed parallel to the ground will be more circular than such features printed perpendicular (or at an angle) to the ground. If you want a circular feature to be perfectly circular, ensure its orientation is such that the feature is parallel to the x–y plane. In the example, the orientation with the longer print time will result in jagged-edged circular features; the orientation with the shorter print time will result in nice-looking, smooth circular features.

Note: The **Auto Orient** button is (from my experience) pretty intelligent and a good place to start.

Once satisfied with the orientation, click the **Add to Pack** button at the bottom.

Pack Tab

The "pack" is the collection of parts you want to print and organize onto a print tray. In Catalyst, some details of the pack are provided:

Model Material: Amount of ABS plastic used to print part

Support Material: Amount of support material used to print part

Time: Estimated amount of time to print the pack. If the pack consists of a single part, then this time represents the time to print the part.

The more material (model or support), the longer your print time. The more parts in the pack, the longer the print time.

Helpful Notes:

1. You can copy and remove parts from the pack in this tab
2. **Repack** will have Catalyst organize the parts on the plate, but (from my experience), it's not very good. It's best to manually organize them.
3. If parts are too close, or overlap, a cross-hatched pattern appears on them as a warning to re-position them.