Review of XYZ Nobel 1.0A Desktop SLA Printer

The XYZ Nobel 1.0A is a desktop SLA (Stereolithography) printer – it uses a UV laser to solidify liquid photopolymer resin to form the printed object. In contrast, most desktop 3D printers are FDM (Fused Deposition Modeling) printers – they extrude plastic filament through a heated nozzle to form the printed object. SLA printers are generally more expensive than FDM printers, have a smaller build volume, and the resin is generally significantly more expensive than the filament for FDM printers. However, SLA printers generally have much higher resolution than FDM printers – that is, they can create objects with finer detail.

The Nobel 1.0A has a maximum build volume of 128 x 128 x 200 mm (approximately 5 x 5 x 7.9 in), and sells for $899.95 (https://shop3duniverse.com/collections/3d-printers/products/xyz-nobel-1-0a). A good place to begin would be the 3D Universe review on YouTube (https://youtu.be/dYmqc9S2X0k).

Since the sale price seemed too good to pass up, I purchased the printer and have been working with it since April 6. The detail produced by this printer is exquisite! Since high detail is evident even on very small models, small models are often more impressive than the same model printer at a larger scale.

Unpacking and Setting up the Printer

Setting up the printer is fairly straightforward. One of the first steps is to flip a switch on the bottom of the printer to release the lock on the build platform. Unfortunately, the manufacturer attached label to the front of the printer noting the position of the lock, and this label is attached using a permanent rather than a temporary adhesive. The best way to remove this label is to spray some WD-40 on a paper towel, apply this to the label, and allow time for the WD-40 to loosen the adhesive. (Do not spray the WD-40 directly on the printer.) Once the label is removed, the remaining adhesive can be removed using isopropyl alcohol.

Be sure to calibrate the build plate using the Horizontal Calibration function prior to installing resin in the resin tank. Place the platform calibration jigs on the right side of the metal frame after the platform has descended to the bottom, and remove these jigs upon completing the calibration. (Some printers do not include the platform calibration jigs in the box, but these can either be printed on an FDM printer, or you can request these from the manufacturer.)

Be sure to update the firmware prior to attempting a print. My printer came with a very old version of firmware that would not print models sliced with the newest software. In my opinion, it would be nice to be able to update the firmware without connecting the printer to a computer, since I normally keep the printer in a different location. For example, this could be done using the front panel by downloading the firmware to a USB flash drive. It would also be nice to be able to use the web to check whether a newer firmware version is available without connecting the printer to a computer.

Preparing to Print (Slicing Software)

The printer requires the use of proprietary software, and in my opinion, the software is the weakest link in the system. It appears as if the Windows software (version 1.1.32.8) and the Mac software (version 1.7.6) are based upon a completely different source code base, making it likely that each platform will have different features and bugs. To test this theory, I sliced the same model using the same options using both the Windows and the Mac software, compared the binary files produced, and they were different. Since the file format is proprietary, I can't determine the nature of the differences.

The Mac software is significantly slower than the Windows software running in a Parallels Virtual Machine running on the same computer – an indication of just how inefficient the Mac version is.

In fact, the Windows version does have an option (Reduce Facets) that is not present in the Mac version, and has two additional options (Cone and Tree) for generating support. Since these two options are not described in the manual, I am not sure precisely when these support options would be appropriate. On several occasions, the Mac software froze when processing a complex model; I was able to successfully process that same model using the Windows software.

The slicing software on either Mac or Windows is slower than the slicing software (Cura) that I use for my FDM printer, and in my opinion, it lacks many important features. For example, Cura allows me to specify shell thickness and infill percentage. The Nobel slicing software, on the other hand, has very few slicing options. Although infill is not appropriate for SLA prints (it would trap uncured resin inside the print), analogous options (e.g. pattern and density of internal support structures) are not available. In fact, if you provide a solid STL model, the Nobel software will produce a solid part, consuming far more resin than necessary. To produce a hollow part, you must preprocess the STL file using Autodesk Meshmixer (a free download). The Nobel User Manual neglects to mention this important first step; fortunately, the 3D Universe review on YouTube provides all the necessary information.

Unfortunately, there are many non-manifold models on Thingiverse and similar sites. Non-manifold models may have areas with no thickness, internal faces, or disconnected edges and/or vertices. Slicers such as Cura usually handle such models with no problem. However, the Nobel software will not slice non-manifold models; such models must first be repaired using Netfabb (https://service.netfabb.com), MakePrintable (https://makeprintable.com), or similar service. The Medieval Castle on Thingiverse (https://www.thingiverse.com/thing:862724) is an example of a non-manifold model that can be sliced with no problem by Cura, but which can not be sliced by the Nobel software.

Finally, generating support using the Nobel software is not as flexible as I would like to see. Ideally, it should be possible to generate support automatically, and then to edit the generated support, to add missing support, delete unnecessary support, or to move poorly positioned support. I have not yet been able to do this successfully on a very large file (the Medieval Castle). When automatically generating support, you can specify external support only, or external and internal support, but there is no way to request internal but not external support. And I was unable to find any way to manually generate internal support, since there doesn't appear to be any way to view or click inside of a hollow model.

I would like to see the Nobel slicing software perform all of these functions: repair non-manifold models, hollow out the models leaving weep holes at the bottom for excess resin to drain, creating internal supports as necessary, and then slice the model.

Resin

An important caveat is that printer requires proprietary resin, which costs $119.95 and up per kg. Each bottle of resin includes an NFC (Near Field Communication, a form of RFID or Radio Frequency ID) chip on the bottom of the bottle. The printer updates the information stored in this chip as resin is consumed, so that it can pause the print when the resin is empty.

I believe a motivated hacker could defeat this system by reading and saving the contents of the NFC chip on a full bottle of resin, and then refilling the bottle and restoring the contents of the NFC chip when the bottle is empty. But it would likely be difficult to find a third party resin that would work as well as the XYZ resin, since the printer uses specific laser intensity and cure times for each different type of resin.

Although XYZ Printing offers different types and colors of resin for the Nobel 1.0A, in my opinion, switching to a different resin is a painful process, and I will probably use only the clear resin. Ideally, it would be possible to use a different resin tank for each type and color of resin. However, the manual cautions that users should always perform a Horizontal Calibration after changing to a new tank or a tank different the one used for last print, and the resin tank must be clean and empty prior to performing a Horizontal Calibration. So, there is no benefit to using a different resin tank for different resin, and the resin tank must be empty and cleaned in order to switch resin.

Printing

The Nobel slicing software provides estimates for the amount of resin and the amount of time required to print each model. In my experience, printing generally takes a bit longer and uses more resin than estimated. For me, resin usage is a bigger concern than print time. (In fact, when slicing, I always choose Good rather than Normal quality to get better prints.)

On one model (https://www.thingiverse.com/thing:1276837) the Mac slicing software estimated resin usage of 25.73 g; the actual weight of the model after washing and drying was 41 g (59.3% higher than the estimate). Another model (https://www.thingiverse.com/thing:2245289) weighed 100 g after draining the excess resin, washing, and drying. The Mac slicing software estimated 82.36 g of resin; the Windows slicing software estimated 81.43 g.

The Resin Status function on the front panel reports an estimate of the total amount of resin remaining in the bottle plus the amount of resin remaining in the resin tank. In my opinion, it would be more helpful and accurate to report only the amount of resin remaining in the bottle, since it is impossible to accurately estimate the amount of resin in the resin tank. The printer can determine from a float in the resin tank only whether the level of resin in the tank is low or adequate.

Although some resin is clearly lost when a print is washed, I have consistently tried to drain as much resin as possible back into the resin tank before removing a print. Thus, I am unable to explain how at 33% complete, a print requiring an estimated 154.27 g of resin would empty my first bottle of resin and require me to install a new bottle when prior to printing, the info panel on the front of the printer reported that my resin supply was at 57% (285 g).

Back to print progress as estimated on the front panel: The percentage complete is based upon the number of layers completed relative to the total number of layers. Since the layers closest to the build platform often use more resin, and therefore take longer to print, it is not unusual for the first 50% to take significantly longer than the second 50%.

Finally, I have not yet had any success printing moveable objects such as the Planetary gear bearing (https://www.thingiverse.com/thing:53451) on the Nobel. My understanding was that SLA would allow closer tolerances when printing than FDM. I would really like to find some recommendations on tolerance and any other related factors required to successfully print such models on the Nobel.

After Printing

When printing is complete, put on nitrile gloves to protect your hands from the resin, remove the build plate, and allow as much resin as possible to drain back into the resin tank. I've found that it helps to use an index card as a squeegee to scoop the extra resin off the build plate. The manufacturer supplies a metal spatula to remove the model from the build plate, but for many models, I've had more luck using a #18 X-Acto knife (https://www.amazon.com/gp/product/B00004Z2U8, which also includes a similar

#17 knife) instead of or prior to the spatula. Work slowly to avoid chipping the model. If the model is hollow and has drain holes, you can allow the excess resin to drip back into the resin tank.

Place the build plate back on the printer. Note that scratches on the build plate are inevitable, and do not degrade the quality of subsequent prints. There is no need to clean excess resin off the build plate.

Rinse the model in Isopropyl Alcohol. If the model is hollow and has drain holes, allow the alcohol to partially fill the model, cover the drain holes, and then gently shake the model to rinse the inside. If the model is small enough, you can place the cover on the rinse basket and gently shake the basket to circulate the alcohol. The longer you leave the model in the alcohol, the duller it will become, so I like to keep the rinse duration very brief – never more than 10 minutes. You can hold the model in the alcohol and use a toothbrush to clean off any excess resin, then allow the model to drain.

The supplied rinse basket (Super Lock by Micronware) has a locking lid so that the Isopropyl Alcohol does not leak or evaporate when the lid is attached. However, it is not tall enough for some models. An alternative is the Tupperware Modular Mate Square 4 (23 cups, $7^3/_8$ inches square x 9 inches tall outside dimensions), available from https://www.amazon.com/gp/product/B006XYKTPS.

If you are looking for a more advanced rinsing solution, you might consider a magnetic stirrer such as https://www.amazon.com/Magnetic-stirrer-magnetic-Stirring-Capacity/dp/B072K24X5P, which uses a rotating magnetic field to cause magnetic capsules immersed in the isopropyl alcohol to stir the alcohol. This emulates the Formlabs Form Wash (https://formlabs.com/tools/wash-cure) except that it lacks a timer and does not automatically lift the part out of the alcohol. Since the Tupperware Modular Mate is slightly larger than the stirrer, I 3D printed an insert to keep the stir bar in the center of the container (http://www.herbweiner.com/insert.zip).

If you are looking for guidance on when your Isopropyl Alcohol solution is depleted and needs to be replaced, you can measure the resin concentration using a Specific Gravity Hydrometer such as https://www.amazon.com/gp/product/B0069TSBQQ. (This will work for Isopropyl Alcohol solution up to 93%; I use 91%.) It is convenient to perform this measurement in a Graduated Cylinder such as https://www.amazon.com/gp/product/B01MCQ4ICH. I have prepared a spreadsheet showing the Specific Gravity of various concentrations of Resin in Isopropyl Alcohol; you can download this from http://www.herbweiner.com/resin.xls.

If the model has supports, remove them after rinsing the model. You can use a pair of small diagonal cutting pliers.

XYZ Printing offers an optional UV Curing Chamber for XYZ Nobel SLA Printers to “increase the hardness and durability of the printed products.” (https://shop3duniverse.com/collections/xyz-nobel-related-accessories/products/uv-curing-chamber-for-xyz-nobel-sla-printers). However, I discovered plans to build my own cure box (https://forum.formlabs.com/t/easy-uv-cure-box-for-under-30/7000/10).

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http://www.herbweiner.com/nobel.pdf
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