Northeastern University
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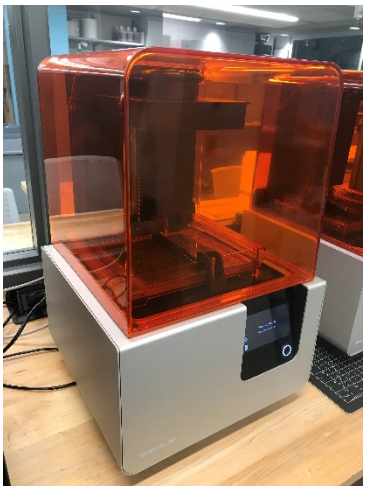
Bioengineering

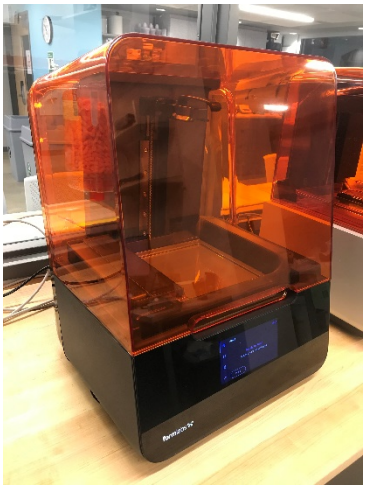
Bioengineering Capstone Collaborative Equipment

2 Form 2 3D Printers



- The Form 2 is a desktop 3D printer that uses stereolithography (SLA) technology and bills itself as the most reliable 3D printer on the market. It has a 145 mm x 145 mm x 175 mm build volume and an x-y-z axis accuracy of +/- 240 um. It uses a 405 nm ultraviolet laser and a 250 mW laser to cure liquid resin into solid parts. This machine can print in a variety of material types, with each material type having a set range of z-axis layer-heights. For instance, Grey resin can print at 160 um, 100 um, 50 um, and 25 um layer height while Tough resin can only print at 100 um and 50 um layer height. The full range of standard and engineering resins can be found at https://support.formlabs.com/s/article/Choosing-the-Right-Material?language=en_US

1 Form 3 3D Printer



- Similar to the Form 2 machine. It uses low force stereolithography (LFS) technology, which makes for easier part and support removal. It has a build volume of 145 mm x 145 mm x 185mm. It has a 25 um XY resolution.

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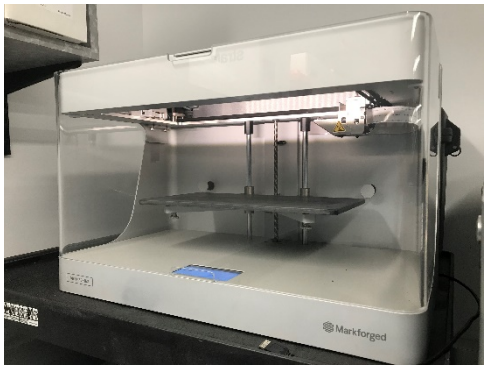
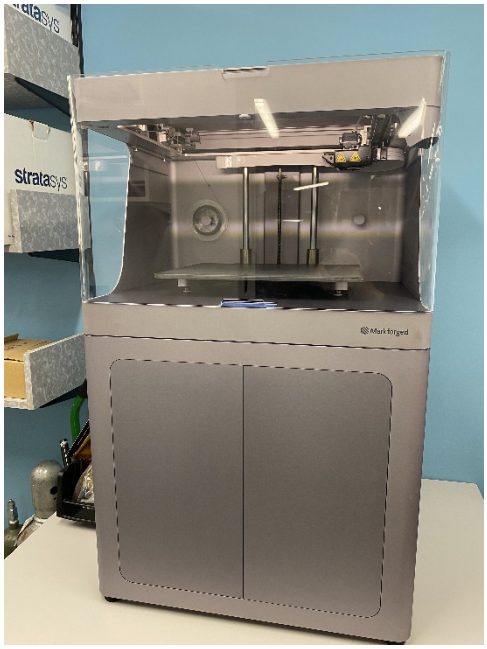
2 Markforged Onyx One 3D Printers



- The Onyx One uses fused filament fabrication (FFF) technology to create dimensionally stable parts that are 1.4 times stronger than ABS. It has a 320 mm x 132 mm x 154 mm build volume,x-y axis accuracy of +/- 125 um, and z-axis accuracy of +/- 100 um. The printer uses a materialcalled Onyx, a mixture of chopped carbon fiber and nylon that is resistant to common corrosivechemicals found in manufacturing. Parts made in Onyx also have a high heat tolerance and a high quality surface finish.

1 Markforged X7 3D Printer



- The Markforged X7 uses continuous filament fabrication (CFF) and fused filament fabrication (FFF) technology to deliver parts with high strength and stiffness. It has a build volume of 330 mm x 270 mm x 200 mm, x-y axis accuracy of +/- 50 um, and z-axis accuracy of +/- 100 um. Parts made with this 3D printer can replace machined Al for a fraction of the cost and time of traditional machining. When using Onyx material without fused filament fibers, this machine can print at a layer height range of 0.05 mm to 0.2 mm. Fused filament fibers can be applied along the Z-axis of the part. When using filament fibers, the machine's layer height is fixed depending on the particular fiber. Four fibers are available for this machine: carbon fiber (layerheight = 0.125 mm), fiberglass (layer height = 0.1 mm), high strength high temperature fiberglass (layer height = 0.1 mm), and Kevlar (layer height = 0.1 mm).

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1 Stratasys F170 3D Printer

- The Stratasys F170 uses fused deposition modeling (FDM) technology to create parts with speed and accuracy. It has a 254 mm x 254 mm x 254 mm build volume and an x-y axis accuracy of +/-0.200 mm or +/- 0.002 mm/mm (whichever is greater). The z-axis accuracy includes an additional tolerance of -0.00/+slice height. This machine can print in ABS-M30 material, which is impact resistant, dimensionally stable, and 25%-75% stronger than standard ABS. When printing in ABS-M30, the F170 uses water soluble supports, which makes it ideal for complex, intricate geometries. ABS-M30 material can print in layer heights of 0.127 mm to 0.330 mm. This machine can also print in PLA, which is a renewable, low-cost plastic that isdimensionally stable and has a low melting point. When using PLA, the F170 can print in a layer height of 0.254 mm.

2 Stratasys F120 3D Printers

- Similar to the F170 machine. These F120 machines are only configured to print with ABS-M30material and water soluble supports. The finest layer-height resolution available is 0.178 mm.

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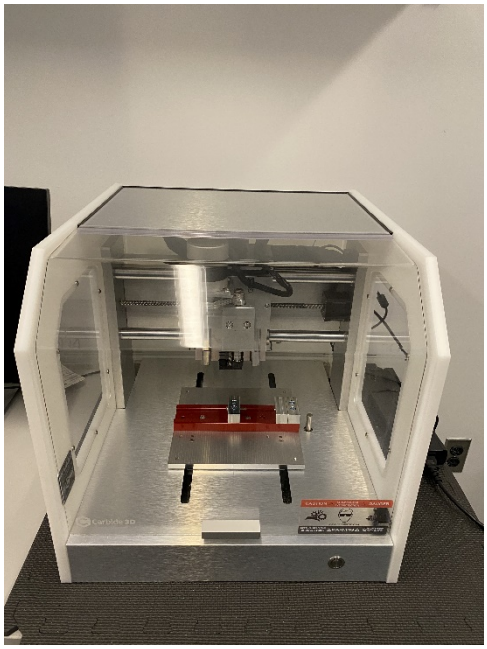
1 Bosslaser LS-1420 Laser Cutter

- The LS-1420 is a professional-grade hobby laser cutter that can cut or engrave organics / non-metals and can mark treated metals. It has a 19.75” x 13.75” cutting area which can accommodate up to 30lbs of material at a time. A FiltraBox COMPACT 3-filter fume extraction system circulates clean air through the machine while it is actively cutting or engraving. The system is cooled by a water pump, An air pump runs when the laser is firing to keep the laser module clear of debris. The laser cutter uses a 65W CO2 laser tube for fast and deep cutting of various materials. Acceptable cutting/engraving materials include acrylic, wood, leather, andplastics. Material thickness can vary but for reference, the machine can cut up to 3/8" wood or acrylic.

1 Nomad 3 Desktop CNC Mill



- The Nomad 3 is a powerful yet compact desktop CNC mill capable of machining a wide range of plastics, wood, and soft metals like aluminum and brass. It has a cutting area of 8" x 8" x 3" and a max spindle speed range of 9,000-24,000 RPM. Max cutter diameter is 1/4".

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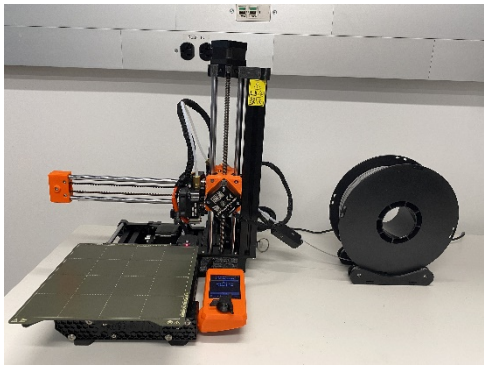
1 Prusa Mini+ 3D Printer



- The Prusa Mini is a versatile desktop 3D printer with a heated build platform. It has a build volume of 18 cm x 18 cm x 18 cm. Layer height ranges from 0.05 mm to 0.25 mm. It is capableof printing in a wide range of filaments including ABS, PLA, PETG, and TPU. Accepted filament diameter is 1.75 mm.

1 Epson SC-P8000 Poster Printer

- The EPSON SC-P8000 is a large-format inkjet printer that uses nine EPSON UltraChrome HDpigmented ink cartridges to print up to a maximum resolution of 2880x1440 dpi with precision dot placement and shape. The printer has a built-in automatic cutter. Paper: EPSON PremiumGlossy Photo Paper (36” wide). Recommended Poster Dimension: 36" x 48".

1 Thwing-Albert Mechanical Tester

- The 1760-2001 Vantage Materials Tester uses MAP4 software. It is similar to an Instron universaltesting machine despite being a different brand and using a different software. Bioengineering has assorted grips for simple compression and tension testing: (1) compression testing to failure or a specified force, (2) tension testing to failure or a specified elongation fatigue testing, and (3) compression to a specified force. Bioengineering does *not* have grips for 3-point bend tests.

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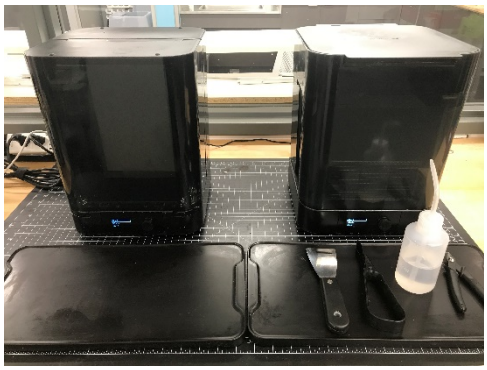
1 SCA 1200HT Wash Station

- The SCA 1200HT is a tank containing 12.2 gallons of water and several packets of Ecoworks,an environmentally friendly cleaning agent. The system uses agitation and temperatures up to85 degrees Celsius to dissolve water soluble support structures generated by the Stratasys F170 and F120 3D Printers. Desupporting times can vary, but several hours can be expected.

1 Form Wash and 1 Form Cure



- The Form Wash is an automated cleaning system that uses isopropyl alcohol (IPA) to removeresidual resin from a model printed on the Form 2 or Form 3 3D printer. It has an 8.6L wash basin. Washing times vary based on the concentration of IPA in the bath and part geometry. Detailed cleaning time using the Form Finish Kit varies based on part geometry.
- The Form Cure post-cures parts printed on the Form 2 or Form 3 by using 405nm wavelengthlight and temperatures up to 80 degrees Celsius. Parts are placed on a turntable moving at one revolution per minute for uniform coverage. Post-curing maximizes material properties such as Young's modulus or ultimate tensile strength. Preheating and curing times vary basedon the resin used.

Contact the Capstone Coordinating Faculty member and the Bioengineering Laboratory Operationsand Safety Manager to discuss in detail. "