FabLab

Summer 2019 Catalog

The FabLab is an on-campus digital fabrication resource for the RIT community. With the right files, you can 3D print, CNC, laser engrave or cut your designs without missing a class. Just submit your files, fill in some details, and we'll handle the rest.

Location
Booth 7A- A620

Hours
Mon - Fri, 9 am - 5 pm w/ student employee hours, when available.

Payment Method
Tiger Bucks

Ticket Portal
http://fablab.cad.rit.edu

FabLab Confluence
http://bit.ly/fablabwiki

3D Printing

Print a model for your thesis, a part for your car, or a prototype of your design. We offer a variety of colors and build volumes for both functional and aesthetic materials.

Pg. 2 - 6

Laser Cutting

For laser cutting, we limit stock thickness to 0.25" for cutting, while etching or engraving is limited to 5.00". The laser cutter is free to use, just remember to drop your stock off.

Pg. 7 - 8

CNC Routing

Our CNC router can cut and engrave 2D and 3D geometries with the corresponding model files. The router is free to use, just remember to drop your stock off.

Pg. 9

FDM Materials

Fused Deposition Modeling (FDM) is great for making rapid prototypes, human factor models, functional parts, even moulds and jigs.

By default, we print FDM models with 20% density, 100µ resolution, and minimal supports. Let us know in advanced if you need your model to be solid, or printed as fast/cheaply as possible (no guarantees).

We stock at least 3 kg of black, grey and white filament, but only ~1 kg of colored PLA, TUP and Nylon filament due to lower demand.

FDM Printers
Ultimaker S5 (x4)
FlashForge Creator Pro (x3)
Rostock Max V3 (x2)

Build Areas
330 x 240 x 300mm
255 x 145 x 150 mm
280 (197 x 197) x 400 mm

Printer models are respective to build volumes.

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MATERIAL	COLOR/NAME	RESOLUTION (µm)	PRICE
PLA Single or Dual Extrusion $1-2, per Build	Black	100 - 300	6¢/g
	Grey	100 - 300	6¢/g
	White	100 - 300	6¢/g
	Blue	100 - 300	6¢/g
	Yellow	100 - 300	6¢/g
	Red	100 - 300	6¢/g
	Natural	100 - 300	6¢/g
Functional Plastics Single or Dual Extrusion $2-3, per Build	Nylon 6	100 - 200	12¢/g
	CF/GF Nylon 6	100 - 200	18¢/g
	Copolyester +	100 - 200	10¢/g
	Polycarbonate	100 - 200	10¢/g
	Polypropylene	100 - 200	12¢/g
TPU 95A Single or Dual Extrusion $1-2, per Build	Black	100 - 200	12¢/g
	White	100 - 200	12¢/g
	Blue	100 - 200	12¢/g
	Red	100 - 200	12¢/g
PVA Dual Extrusion Supports Only $2 -3, per Build	Natural	100 - 300	13¢/g

SLA Materials

Stereolithography (SLA) printers produce incredibly detailed models, mirroring the dimensional accuracy of injection molding. Unlike FDM, SLA prints are isotropically solid and require a post-cure to fully set the resin.

Standard resin is best for aesthetic, non-functional models. Functional resins mirror various plastics, including Nylon, PP and PC. As their individual names indicate, there's a functional resin for a variety of applications.

NOTE*
Ceramic resin has additional prerequisites for model design/features, printing, firing and glazing. For more information, visit http://bit.ly/2NurewY.

SLA Printers
Formlabs Form 3 (x1)
Formlabs Form 2 (x4)

Build Areas
145 x 145 x 185 mm
145 x 145 x 175 mm

Ticket Portal
http://fablab.cad.rit.edu

FabLab Confluence
http://bit.ly/fablabwiki

MATERIAL	COLOR/NAME	RESOLUTION (µm)	PRICE
Standard Resin $2.50, per Build	Black	25 - 100	20¢/mL
	Grey	25 - 100	20¢/mL
	White	50, 100	20¢/mL
	Clear	25 - 100	20¢/mL
	Apricot	25 - 100	20¢/mL
	Azure	25 - 100	20¢/mL
	Draft	300	20¢/mL
Engineering Resin $3, per Build	Durable	50, 100	30¢/mL
	Elastic	100	30¢/mL
	Grey Pro	50, 100	30¢/mL
	High Temp	50, 100	30¢/mL
	Rigid	50, 100	30¢/mL
	Tough	50, 100	30¢/mL
Specialty Resin $3.50, per Build	Castable Wax	25, 50	45¢/mL
	Ceramic*	25, 50	45¢/mL

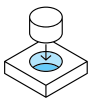
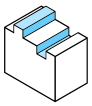
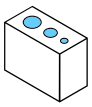
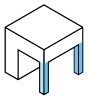
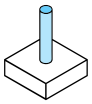
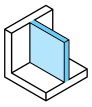
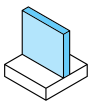
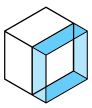
FDM
Grey PLA, printed at 100µm with 20% infill.

SLA
Grey resin, printed at 25µm with 100% infill.

Features

These are the minima that are achievable with FabLab printers. Use these examples to guide your design process, thereby increasing the likelihood of your design printing successfully.

Specialty materials like TPU filament or Ceramic resin have a greater chance of deviating from tolerances beyond +/- 3%. Before committing to a special filament, consult with a FabLab 3D Tech or the manufacturer for design and tolerance tips.

FEATURE			FDM	SLA	SLS
Bridge	The span a platform can print without requiring supports.		10 mm	21 mm	Inconsequential
Interfacing Clearance	Clearance between two parts that either move (M) or connect (C).		M: 0.5 mm C: 0.5 mm	M: 0.5 mm C: 0.5 mm	M: 0.3 mm C: 0.1 mm
Engraved & Embossed Details	The span a platform can print without requiring supports.		W: 0.6 mm H: 2.0 mm	W: 0.3 mm H: 0.1 mm	W: 1 mm H: 1 mm
Escape Holes	The minimum size of escape holes that allow accumulated material to be evacuated.		Not Necessary	3.5 mm	5 mm
Hole Diameters	The minimum size a platform can successfully print a hole.		ø1.0 mm	ø0.5 mm	ø1.5 mm
Minimum Features	The recommended minimum size of a feature to ensure it will not fail to print.		2 mm	0.2 mm	0.8 mm
Minimum Filleted Radius	The recommended minimum size of a fillet between at least two or more walls.		1 mm	0.8 mm	1 mm
Pin Diameter	The recommended minimum size of a feature to ensure it will not fail to print.		ø3.0 mm	ø0.5 mm	ø0.8 mm
Supported Walls	Walls that are connected to the rest of the print on at least two sides.		0.8 mm	0.5 mm	0.7 mm
Unsupported Walls	Unsupported walls are connected to the rest of the print on less than two sides.		0.8 mm	1 mm	Inconsequential
Supports & Overhangs	The maximum angle a wall can be printed at without requiring support structures.		45°	Always Required	Inconsequential
Tolerance	The expected dimensional accuracy of a platform.		±0.5% (Lower Limmit ±0.5mm)	±0.5% (Lower Limmit ±0.15mm)	±0.3% (Lower Limmit ±0.3mm)

Design Guide

Printers
Ultimaker S5 (x4)
Formlabs Form 3 (x1)
Formlabs Form 2 (x5)
FlashForge Creator Pro (x3)
Rostock Max V3 (x2)

Build Areas
330 x 240 x 300 mm
145 x 145 x 185 mm
145 x 145 x 175 mm
255 x 145 x 150 mm
280 (197 x 197) x 400 mm

Printer models are respective to build volumes.

3D printing literally adds another dimension of complexity to the digital design process. CAD software enables us to swiftly turn ideas into actionable concepts. 3D printing, unfortunately, does not offer the same degree of fluency. Though it is *possible* to print all kinds of shapes in varying sizes, colors and materials, you must keep in mind which designs print *best* and *why*.

Surfaces
Models constructed with surfaces (features that are inherently not solid bodies) can be printed, however you must make sure to convert all surfaces into one singular mesh, per file. Surfaces must also be properly joined, not grouped; meaning extraneous geometries must be cut and deleted from the file. Failing to remove even negligible scraps will ultimately doom your model when printing.

Remember to drop your model to the top plane, or zero the flattest part of your model along its z-axis. If we discover conflicting or damaged surfaces, or models that are floating or improperly zeroed, your ticket will be put on hold until you upload the revised file(s).

Walls
Walls are the faces that outline a model. Just as the name suggests, they are as much a structural component as they are aesthetic. It is important to remember that walls also hold a model in tact while printing. If your walls are too thin or absent altogether, the print can fail—even when using supports.

Overhangs
The “Y-H-T Rule” is a helpful way to remember what designs are safe to print without supports, and which to avoid.

Anything in a “Y” shape is safe because it’s a gradual slope that still has enough material beneath it to avoid drooping. This is another interpretation of the 45 Degree Rule, which states that overhangs with a slope greater than 45º will require supports. The more gradual the slope, the better. This is why conical shapes generally print hassle-free.

Anything in an “H” shape—where a central overhang connects two or more sides—is called a bridge. Typically, bridges shorter than 36 mm can print with drooping of 0-0.5 mm; bridges 36 to 60 mm print with drooping of 0.5-2 mm; and bridges longer than 60 mm tend to droop significantly, around 2-5 mm. These rules aren’t set in stone, however, since it depends on the material and print settings.

Anything with a “T” shaped overhang will have insufficient support and almost certainly fail to print properly. There just isn’t enough to hold the material up in this configuration.

Supports
Models with overhanging features—or geometries that extend out and away from a model’s footprint—need some soft of structure to support the filament or resin as it builds. This is where supports come into play.

Supports are extra material that act as scaffolding to hold a body in place if there is not enough inherent support to build on. Depending on your design, removable supports may be needed to prevent filament from drooping or resin from shearing.

Water-Soluble Supports (PVA)
There are instances where a model may need supports to print, but removing them afterwards with pliers and knifes may damage the model, or be impossible altogether. Enter PVA: support filament that dissolves in soapy water. When used with PLA or CPE+, PVA-supported prints can contain small or thin overhangs, cavities, even interconnected moving parts printed in one assembly!

The drawback with dual-extrusion printing, other than the increased costs and build times, is the risk of failure. Adding another material halves the chances of success from 1:2 to 1:4. Consult with a 3D Tech before choosing PVA supports.

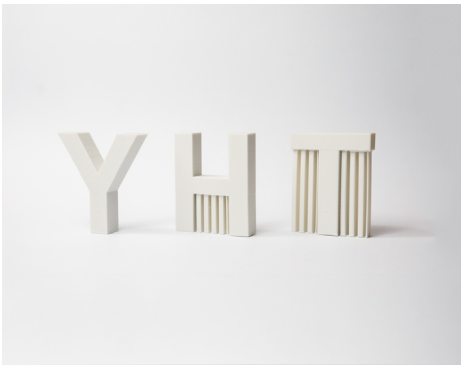
Although supports are sometimes necessary, there are a lot of benefits to designs that avoid supports altogether.

Saving Time & Money
Designs that require a lot of supports waste material, since they are discarded once the print is complete. Additionally, adding supports means the design will take longer to print (more material = more time), and we've seen supports increase print time by up to 200%. Factoring in the time required to remove the supports, the difference in completion times can be significant.

Creates Smoother Surfaces
Using supports typically creates a rougher surface and again, requires more work during post-processing to smooth it out. In some cases, supports may obstruct or damage model surfaces beyond reasonable repair.

Split the Model into Multiple Pieces
Another way to avoid supports is to split your model into multiple pieces so they can print flat. Once printed, you can join them with an adhesive like cyanoacrylate (super glue). This is useful for complex designs and larger prints. Additionally, you can implement registration pegs and sockets into your design, possibly creating an assembly with little to no adhesive.

PVA supports allows models with interconnected parts or fine geometries to successfully print, while making their removal as easy as taking a bath. Images: Ultimaker.



These models demonstrate how slicing software responds to bridges and overhangs that require additional support. Note how only the "Y" model is free of any supports.

Laser Cutting

Max Dimensions
24” x 18”

Max Cut Depth
0.25”

Formatting
All Strokes: 0.001”
Raster Engraving: Black & White
Cutting: FF0000
Scoring: 0000FF

Permitted Materials
Cardboard, Uncoated Paper, Chip/Matboard, Acrylic, Plywood, Balsawood, Domestic Hardwoods, MDF, Masonite, Cork, Vegetable Tanned Leather, Unmounted Linoleum

Illustrator Template
http://bit.ly/fablablctemp

FabLab Confluence
http://bit.ly/fablabwiki

First, download the laser cutter template file, insert your objects and format them according to their intended operations. Double-check that your color profile is set to RGB, not CMYK; your units are set to inches; there are, at most, three colors in the entire document (they must be the hex values shown on the left, or defined by the swatches already saved in the template); and, if you’re building a 3D object using a flat-pack design, you’ve accounted for the thickness of your stock in your model’s dimensions.

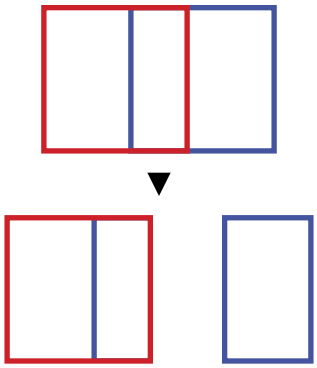
Please setup your file before submitting it, otherwise your request will be rejected (we don’t want to do *everything* for you!).

The FabLab does not currently supply any stock for the laser cutter. Please use the “*Material Guide*” on the CAD FabLab Confluence for a list of accepted materials and trusted suppliers.

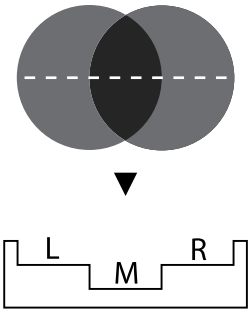
Vector vs. Raster
A vector object is interpreted by the CAM software as a cutting or scoring operation, while a raster object (i.e., an image) is interpreted as an engraving operation. For cutting, setup your objects as vectors using a stroke of 0.001” (0.0254 mm) with no infill. Note the color of the stroke defines the operation, see key on the left.

When creating complex shapes, cut and remove extraneous strokes. Covered or masked strokes will not be ignored by the CAM software, resulting in unintentional paths. Note that hidden layers or individual elements will be excluded form any operation.

Overlapping raster objects will have their non-visible bodies automatically mapped, so only the visible elements will be engraved. If, however, your overlapping raster objects have translucent backgrounds, they will be engraved up to twice as deep at the overlap.



Vector Objects
The red strokes are cut paths and blue strokes are score paths. A square is engraved (blue), then cut out by the red square, resulting in only one square with a single vertical score.



Raster Objects
The two circles have the same 25% black fill, but the overlapping space will be engraved as a 50% black—twice as deep as either circle.

Engraving Photos

A photo is a raster object, meaning it is composed of elements that loose quality or clarity when scaled (or resized) beyond 100% of its original size. To engrave a photo with the laser cutter, you first need to convert your image to black and white, then posterize the values to a range to greater than 8 but less than 30. This helps create a simpler range of contrast for the laser to engrave. Otherwise, a color photo is immediately interpreted by the laser cutter's software as black and white, obscuring details of the image indiscriminately.

Use Photoshop to first, convert your image to black and white (Image > Adjustments > Black and White...). Observe the contrast between the elements you're trying to preserve and adjust the sliders accordingly. More or sharper contrast will increase the legibility of the image when it's engraved.

Once you've converted it, posterize your image (Image > Adjustments > Posterize...). Play around with how many levels of black define enough of your image to make it just legible. Too many levels will flatten the image once it's engraved. Once your image is set, insert and embed it (as in store the image within the AI file) into the ULS V460 Illustrator template.

Observe how the black and white version, with the yellow and red values tweaked to increase the contrast of the body and bill, translates into a posterized image.

Original

Black & White

Posterized, 15 Levels

Engraving Text

White it is possible to engrave text onto any of the approved materials, the body of text itself cannot be a text element in the Illustrator file. This means that, if you have raw text in your file, it must be converted into a vector shape (Object > Expand...) composed of either fill or stokes as outlines. Non-vectorized text will not open on the laser cutter's computer properly, so the font you choose will be ignored

Materials

All materials listed above are safe to use for vector and raster engraving, as well as vector cutting (except for glass). Stock must be no larger than 24" x 18" and 1/4" thick. Submit a ticket for your request first, then bring your stock to the FabLab. If you're unsure about what your material may be or if we can accept it, swing by and 3DTech will help you out.

We will immediately reject PET, PS, ABS, Vinly, PVC, Nylon and Foamcore due to toxic emissions; warped Plywood, Corian and casting wax due to mechanical hazards to the laser; and tropical woods due to emission of foreign agents.

CNC Routing

Working Area
24” x 30” x 5”

Permitted Materials
Modelling Foam, MDF, Hard and Softwoods, Plywood, Acrylic

Available Bits
1/2”: Square End, Ball End
3/8”: Flat End, Ball End
1/4”: Flat End, Ball End
1/8”: Flat End, Ball End
1/16”: Flat End

FabLab Confluence
http://bit.ly/fablabwiki

The ShopBot is perfect making pieces of a design that are too large or thick for the laser cutter. Similar to 3D printing, submit your model as an STL or Illustrator file, then hand off your material to a FabLab 3D Tech in the ID wood shop.

Once a 3D Tech has both your file and stock, if not done via Fusion 360 or another ShopBot CAM tool, we can setup your toolpaths, speeds and finishing steps. Depending on your model and the material, routing can take anywhere from 20 minutes to two hours, or longer.

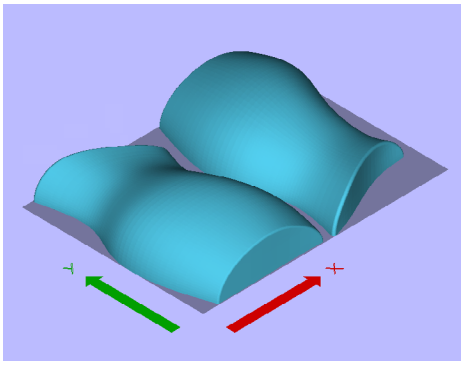
Most models typically need more than one operation to further define geometries or remove a part from the stock itself. A 3D Tech will monitor the process, however we ask that you stay for the first few passes to check that the correct design is being routed.

It is also important to be aware of the router’s abilities *and* limitations. The height of a model above the working surface is defined by the vertical travel height of the tool. If your model is too tall to carve, cut it in half and lay the pieces side-by-side. Afterwards, you can glue both pieces together.

Choosing a Material
Finding the best material for your design is defined by the process itself. With a router, rigid and stiff materials that ship as flat sheets work best. This includes acrylics, hard and softwoods, MDF, and polyurethane modeling foams. We will not accept materials that are excessively flexible or soft like elastics or fabrics, as these are incompatible with the process and create dangerous operating conditions.

Pliable materials—like foams—are quicker to work with but, when compared to MDF or acrylics, produce weaker and/or less functional models. If your model will be painted or stained, used for casting, thermoforming or jigging, consult with a 3D Tech about a composite or hardwood material.

For designs with small or intricate details, it is highly recommended to avoid plywoods or laminates. Thin edges or features cause the top and bottom plies to splinter, creating rough edges that require excessive post-processing to correct.



A 3D model that’s been divided into two pieces to avoid flipping and re-zeroing the work, reducing run time.

Submit a Ticket

Location
Booth 7A- A620

Hours
Mon - Fri, 9 am - 5 pm w/ student employee hours, when available.

Payment Method
Tiger Bucks

Ticket Portal
http://fablab.cad.rit.edu

FabLab Confluence
http://bit.ly/fablabwiki

Ready to make something? Great! Now you need to submit a ticket to the FabLab Service Desk. You can access it with the link on the left but before you do, there are a few things we need to cover.

Create a Ticket
Please submit all files under one ticket. Submitting multiple tickets, including tickets created by responding to a ticket via email, will be closed and consolidated within a single ticket.

Payment
The FabLab only accepts Tiger Bucks; no cash, credit or debit cards. Prior to pickup, double-check your balance. If you do not have Tiger Bucks: login to eServices, click on the "*Dining Accounts*" tab, then in the "*Add Funds to Dining Accounts*" section, and select your Tiger Bucks account. Follow the credit card payment process and after you receive an email from eServices, you're all set to checkout.

We ask that customers pay for their ticket once it is completed and ready for pickup. This allows us to print your model as best we can and charge you accordingly.

Delinquent Tickets
If a customer abandons or refuses to pay for a model, they will be blacklisted. 'Blacklisters' may still submit tickets to the FabLab, however they must first pay all outstanding balances upfront before any new quotes can be generated.

Turn-Around
Once we have your file and printing specs, all you have to do is wait! Look out for emails regarding updates to your ticket's status—including possible complications with your file, or when your model is ready for pickup.

Remember: SLA prints can take up to 2 hours to post-cure, depending on the geometry of and resin used for the model. We explicitly enforce a 24 hour turn-around for all jobs, printing or otherwise.

All sales are final. We do not charge for failed prints, but will charge for models that have been printed after you've updated your CAD.

Glossary

Acrylic (PMMA)
Polymethyl methacrylate is the same plastic used to harden manicured nails. Commonly used in lieu of glass for safety and aircraft windows, it comes in a variety of shapes, sizes and colors. NOTE: PET/G is not acrylic and cannot be laser cut due to hazardous fumes.

Acrylonitrile Butadiene Styrene (ABS)
A recyclable composite thermoplastic used to make car bodies, computers housings, consumer electronics and other appliances.

Build/Working Area
A bounding box in which a CNC (3D printer, laser cutter, router, etc.) may operate on stock with one or more tools, processes and checkpoints.

Castable (Resin)
Used to print a positive for lost wax casting, typically with Brass, Gold and Silver. Once cured, castable resin is a substitute for paraffin wax.

Castable Wax (Resin)
Used to print a positive for lost casting, typically with precious metals. Capable of registering details down to 25µ, it is explicitly intended for use with jewelry casting.

Computer Numerical Control (CNC)
The automation of machine tools via computers executing pre-programmed sequences of machine control commands.

Copolyester (CPE)
A class of thermoplastics that are chemically resistant, tough and demonstrate good dimensional stability. CPEs are ideal choice for both functional prototypes and mechanical parts.

Curing
A permanent post-processing step that chemically alters a thermoset's physical state by using heat and/or light to activate an initiator.

Cyanoacrylate Glue (CA)
Commonly known as super or "Krazy" glue, CA is a biodegradable adhesive that creates a plastic bond between two surfaces. It's great for repairs, assembling prints, and sealing an open wound.

Fused Deposition Modeling (FDM)
A CNC process utilizing a continuous strand of a molten thermoplastic to sequentially build layers of a 3D object.

Hardwoods
A group of dense woods, typically sourced from flowering (angiosperm) trees. Common examples: Birch, Cherry, Maple, Oak, Poplar and Walnut.

Infill
Material that is used to fill the interior of a print, quantified as percentages with 100% being a solid object. FabLab default infill for FDM is 20%, SLA is 100%.

Layer
A single section, or slice, of a model, consisting of infill, walls, as well as top and bottom faces. Decreasing layer height increases overall resolution and print times.

Low Force Stereolithography
A deviation of SLA developed by Formlabs that brings layers up to a printing surface rather than pushing the printing surface into subsequent layers.

Medium-Density Fiberboard (MDF)
A composite building material made from finely shredded wood fibers, resins and adhesives.

Micrometer (µm)
A unit of length equal to one millionth of a meter. It is commonly used to quantify XY layer resolution of 3D prints: smaller numbers translate to more resolution.

Nylon/Polyamide (PA 6, 9, 11, 12)
A tough, lightweight, semi-elastic thermoplastic often used in medical, aerospace and consumer applications.

Glossary

Photopolymer
A thermosetting resin whose properties are permanently altered when exposed to visible or ultraviolet light.

Polylactic Acid (PLA)
A renewable thermoplastic derived from vegetable starch, typically used for prototyping and low-cost, low-thermal load applications.

Polypropylene (PP)
A low-friction thermoplastic with high fatigue, chemical, temperature, and electrical resistance—making it one of the most widely used plastics on the planet. PP is the go-to material for functional prototyping and end-use products—especially living hinges.

Polyvinyl Alcohol (PVA)
A water-soluble thermoplastic used in dual-extrusion 3D printing for supporting hard to reach geometries.

Raster
An image or object rendered by way of pixels at a static resolution (photos). Scaling beyond the dimensions results in a loss of clarity (pixelated).

Router/Routing
A cutting machine—hand-held or CNC'd—used for cutting various hard materials, such as wood, composites, aluminium, steel, plastics, and foams.

Softwoods
A group of woods, typically sourced from cone-bearing (conifer) trees. Common examples: Cedar, Douglas Fir, Hemlock, Larch, Pines, Spruce and Yew.

Stereolithography (SLA)
A CNC process utilizing an ultraviolet laser to cure photopolymer, sequentially building layers of a 3D object. The resulting print is highly detailed, and cannot be recycled or melted back down.

Stock
A standardized raw material ready to be worked on by a CNC tool or machinist, and ships as bars, plates, sheets, tubes and pipes.

Thermoplastic
A synthetic material that—when subjected to a specific range of temperatures—becomes pliable or molten until it is allowed to cool. This process is repeatable unless the polymer is destabilized by long-term exposure to a chemical agent, visible/UV light, heat or ionizing radiation.

Thermoplastic Polyurethane (TPU)
A group of thermoplastics with a specific range of physical characteristics—including elasticity, transparency, and resistance to oil, grease or abrasion.

Thermosetting Polymer
A synthetic material that—when subjected to heat, light or a chemical agent—undergoes permanent physical alterations. Thermosets cannot be melted or reshaped, and burn in the presence of heat or radiation.

Vector
An image or object rendered as lines, defined by nodes tied to mathematical theory in a computer program (Adobe Illustrator). Vectors are infinitely scalable without any loss in quality.

Additional Resources

SUPPLIES

McMaster-Carr

McMaster-Carr Supply Company is a private supplier of hardware, tools, raw materials, maintenance equipment and supplies. McMaster maintains a wide variety of mechanical, electrical, plumbing, and utility hardware not usually located from a single source.

Inventables

If you're looking for colored or multi-colored acrylic, various plastics, raw metals and even circuit board blanks, you can find it on Inventables' shop. If you're going to be laser cutting/engraving, make sure you purchase PMMA acrylic and not HDPE or PET.

Digi-Key

The best place to order electronics and electrical components is Digi-Key. LEDs, power supplies, sensors, board components: you name it, Digi-Key has it. Double-check your designs before ordering, as some components may not be returnable.

Amazon

We recommend looking for supplies on Amazon, especially because Prime members save on shipping and unit costs. We also have a Shared Idea List of the very supplies we use and recommend.
Link: http://a.co/4l2c6c1

KNOWLEDGE

FabLab Confluence

The FabLab has articles for design tips, tricks and techniques that everyone can use in their designs. We also have guides for post-processing your prints, including how to make optically transparent clear resin, living hinges with Polypropylene, and more!
Link: http://bit.ly/fablabwiki

The Construct

The Construct has a variety of rapid prototyping facilities available for use, including 3D printers, Laser-cutters, and CNC mills, as well as workspaces for electronics, metal/woodworking, and CAD design. We also provide some materials for getting your project going, and free consulting from our community of student makers.
Link: http://hack.rit.edu

3D Hubs

For detailed design guides beyond what we have in this catalog, visit 3D Hubs' design guide for 3D printing. If you're curious about other digital fabrication tools, explore their other sections on CNCs and laser cutters.
Link: http://bit.ly/3dhubs3dp