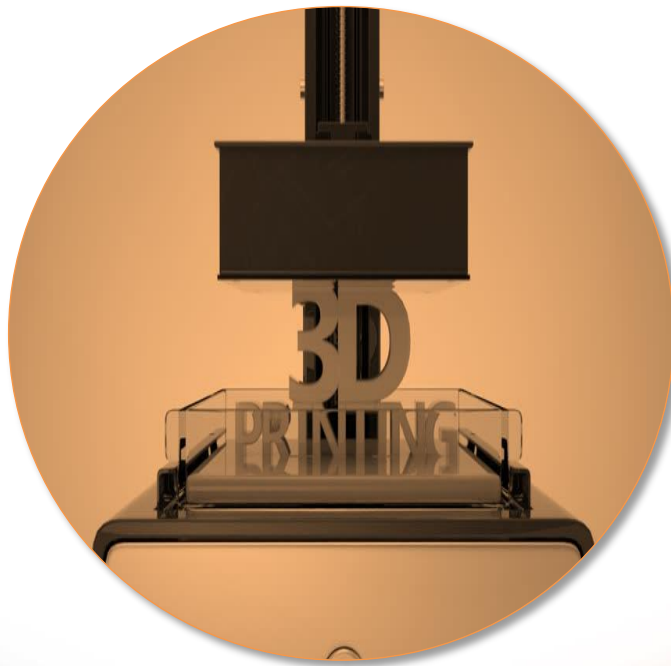# 3D Printing

What is 3D Printing?

Welcome to the world of 3D printing. Whether you are new to this world or already have some experience with it, we're happy that you stopped by.

3D Printing is the process of continuous adding layers of material with a computer controlled device to create a three-dimensional object. It's more broadly known as additive manufacturing, because you add material to make a part, rather than cut it away from a piece of stock.

3D Printing Processes

A large number of additive processes are now available. The main differences between processes are in the way layers are deposited to create parts and in the materials that are used.

Some methods melt or soften the material to produce the layers, for example. Selective laser melting (SLM) or direct metal laser sintering (DMLS), selective laser sintering (SLS), fused deposition modelling (FDM), or fused filament fabrication (FFF), while others cure liquid materials using different sophisticated technologies, such as stereo lithography (SLA).

With laminated object manufacturing (LOM), thin layers are cut to shape and joined together (e.g., paper, polymer, metal).

3D Print requirements

A regular A4 paper printer can't produce a printed photo by itself. You need a digital photo, paper and ink to use a paper printer successfully. A 3D printer also needs several, comparable things to create its models.

3D file

To create a 3D object, a digital 3D object is needed. This is commonly known as a CAD file and can be made with a lot of different programs like Tinkercad, SketchUp or Solidworks. A 3D scanner can also be used to create a digital 3D model. In comparison to a paper printer; this would be the digital photo.

Filament

The CAD file can be converted to a printable file using the right software on your computer. Then, the file can be built with a material which you can load into your 3D printer. This 3D print material is called filament and can be compared to ink and paper on a regular paper printer

Time to take to 3D print any object

The time taken to print any object depends upon the size of the object and settings set for an object. A small object with less dimensions and infills can be printed in less than an hour. Objects with higher dimensions will take several hours to print.

Materials Basics

Filament is the printing material; the most commonly used filaments are ABS and PLA. Every filament has its strengths and weaknesses which lead to different results while printing.

- PLA - Odourless, low warp, eco-friendly, stiff, easy to print
- PLA PRO - High quality, vibrant coloration, stiff
- ABS - Stronger and good heat resistance, low costs
- PVA - Water-soluble support material
- HIPS - Support material for ABS
- Hybrid - Strong, Tough, Food safe
- Nylon - Strong, durable, versatile, light
- Brick - Brick fibres
- FLEX - Flexible
- Wood - Wood fibres

Cost involved in 3D Printing

There is an initial investment involved. You need to take into account the price of the printer, the software, the spools or filament. But in the long run, 3D printing promises to be a cost-effective option.

CAD to .STL

• When you want to make a print, you need to convert your design to a code that the printer can read. To make your design into a digital model you will need 3D CAD software. This type of software is different than the 3D slicing software that you will hear about in the next section.

• 3D CAD software is used to draw a 3D model of your idea. If you are not familiar with the various types of 3D CAD software available, we suggest that you would take a look at Tinkercad by Autodesk. In Tinkercad you will learn the basics of 3D design that are very useful in designing your own 3D models. An alternative program is Sketchup.

• Regardless of what design software you use, you need to be able to save the model as a .stl file type. This is one of the most common file formats read by 3D slicing software programs. The .stl file describes only the surface geometry of a three dimensional object without any representation of colour, texture, or other common CAD model attributes.

• A wide variety of .stl files are available on the internet, so don't worry if you are not as familiar with CAD design!

Time to learn 3D Modelling

You can learn using 3D models by means of modelling tools like Rhino, SketchUp or Blender. Use them and in about 6 months, with the help of considerable study and regular practice, you can pretty much surprise yourself with what you will be able to create!

.STL to GCODE

• To create a printable file, the stl file has to be processed by a slicer.

The output of the slicer software is in a G-code, which is the file name. It translates your model in instructions the 3D printer can understand. It is like a list of commands and information for a 3D printer. A G-code tells the printer when and how to move and contains all information about that particular print, necessary to create a successful print.

3D Printing Applications

The original use of 3D printing was centred on rapid prototyping. In the following sectors, 3D printing is used in variety of ways and the possibilities keep growing every day.

- Medical sector - low-cost prosthetic part
- Aerospace sector - prototyping
- Automotive sector - prototyping
- Jewellery sector - unique jewellery
- Art sector - unique possibilities
- Architecture sector - smooth and durable architecture models
- Education sector - enriched learning
- Fashion sector - unique designs
- Food sector - sustainable packaging

3D Printing Benefits - Industry

Time-to-Market: 3D printing allows ideas to develop faster than ever. Being able to 3D print a concept the same day it was designed shrinks a development process from what might have been months to a matter of days, helping companies stay one step ahead of the competition.

Mitigate Risk: Being able to verify a design before investing in an expensive moulding tool is worth its weight in 3D printed plastic, and then some. Printing a production-ready prototype builds confidence before making these large investments. It is far cheaper to 3D print a test prototype then to redesign or alter an existing mould.

Get the Feel: One thing you can't get from a picture or virtual prototype on the computer screen is the way something feels in your hand. If you want to ensure the ergonomics and fit of a product are just right, you must actually hold it, use it and test it.

Build your Imagination: In the modern boom of digital art and design, the possibilities are not only accelerating but limitless. One can now 3D print almost anything they imagine after drawing it up virtually. In a relatively short time, an idea, concept, dream or invention can go from a simple thought to a produced part that you can hold.

Fail Fast, Fail Cheap: Being able to test ideas quickly and discover what doesn't work accelerates discovery leading to an ideal solution. 3D printing allows a product developer to make breakthroughs at early stages that are relatively inexpensive leading to better products and less expensive dead-ends.

3D Printing Benefits - Education

Creating inventors: 3D printing technology positions students as creators. Instead of consuming the creations of someone else they become the inventors.

Making everything hands on : Seriously, everything can be hands on. Learning about ancient societies? Design and print a model of a mummy or a pyramid. Learning about land forms? Design and print a peninsula or a mountain range. Learning about natural disasters? Design and print tools to protect you during a disaster. The list goes on and on...

Improved learning methods: Even though students are traditionally taught through books and theory, kinaesthetic learners prefer to learn through using aids and materials. 3D printing allows you to bring any subject matter to life as a physical aid to engage all of your students, for a longer period of time, increasing their learning and improving their problem solving and critical thinking capabilities.

Comprehending concepts: In addition to integrating 3D printing for the purpose of learning to use the technology, it can also help in the process of understanding other concepts. For example, teachers can create models to help illustrate concepts in a physical way. Great for visual hands-on learning.

Promotes critical thinking and problem solving-skills: In areas of education where students must exercise critical thinking and problem-solving skills, a 3D printer can assist immeasurably.

BE SKILLED ▶ ▶ BE MORE