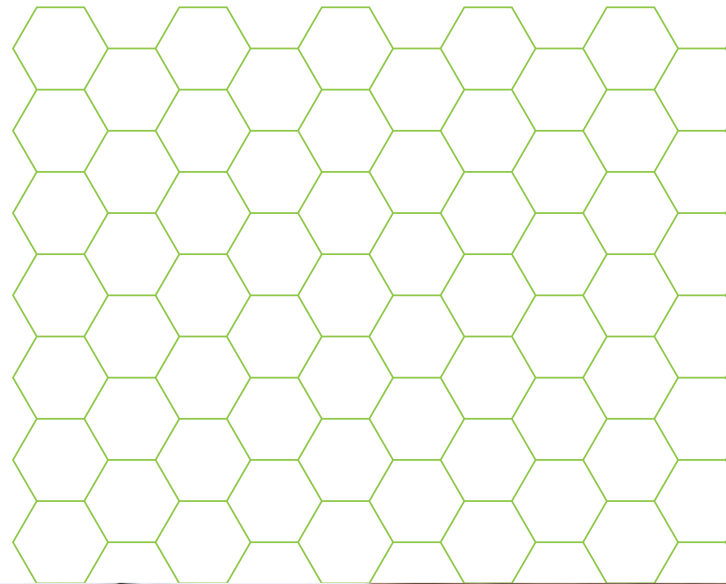# Getting started with office 3D printing

Ultimaker

Getting started with office 3D printing

Contents

Introduction

With its multiple benefits, 3D printing presents both an exciting and potentially overwhelming prospect. When you're introducing in-house 3D printing, it can therefore be daunting to consider the workflow and process changes needed. A pragmatic approach is necessary, based on identifying the key time and cost-saving opportunities. These include:

- Faster prototyping cycles
- Less design process interruption
- Reduced lead times when compared with outsourcing
- The ability to evaluate more design iterations, improving product quality
- Rapid ROI and cost savings
- The ability to customize tools and other end-use parts

3D printing technology

Fused filament fabrication (FFF) is the most widely adopted 3D printing technology in the world. The process involves material being extruded from a heated nozzle, and deposited on a build plate in thin layers, to form a printed object. The extruder moves horizontally to deposit material on the build plate, which moves vertically after each layer is completed.
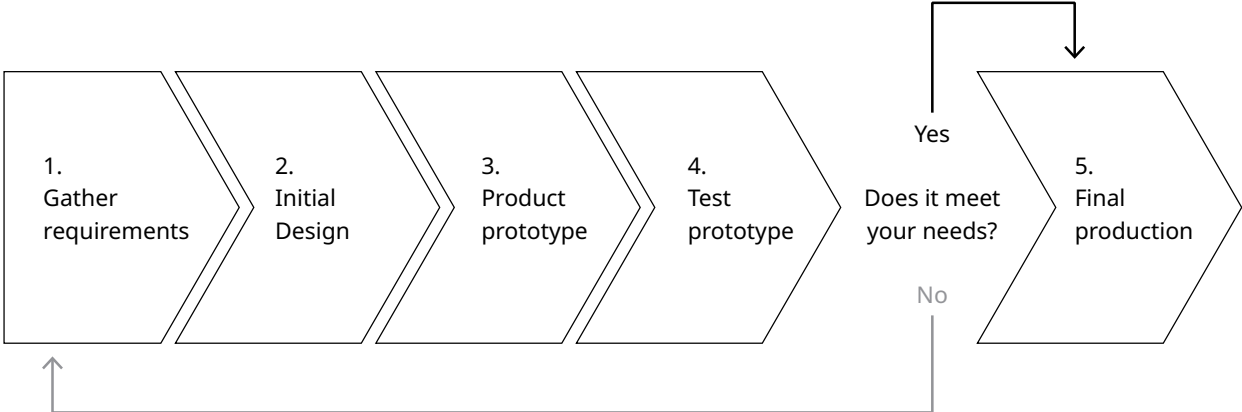
FFF offers multiple advantages, including the broad availability of a range of materials. These are inexpensive and ideal for producing multiple applications, from prototypes to final product fabrication. FFF 3D printers can also be used for applications such as mold creation, tooling, and low-volume custom part fabrication.

Workflow and integration

Product design follows a definitive process. In-house 3D printing makes this process more efficient by streamlining the prototyping and testing phases and enabling more design iterations. This reduces costs and turnaround times and results in higher quality products.
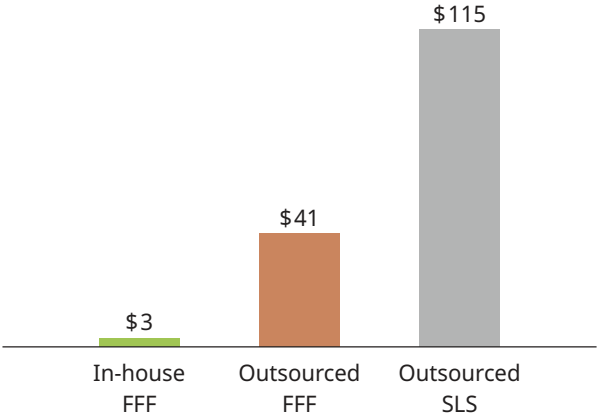
The typical product development process

1. Gather requirements → 2. Initial Design → 3. Product prototype → 4. Test prototype → Does it meet your needs? (Yes → 5. Final production / No → back to 1)
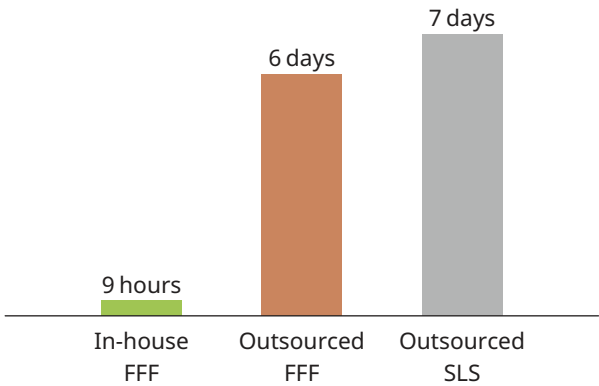
In-house vs outsourced

Successful product development requires extensive prototype fabrication and testing. In the past, prototyping was outsourced, adding significant costs and lead times to the product development cycle. 3D printing is a cheaper and faster alternative, allowing for more iterations to be incorporated into the design process. This combination of time and cost saving offers a competitive advantage and results in better products within a shorter time frame.

Cost per part

- In-house FFF: $3
- Outsourced FFF: $41
- Outsourced SLS: $115

Project lead time



- In-house FFF: 9 hours
- Outsourced FFF: 6 days
- Outsourced SLS: 7 days

Examples based on a 60 cm³ prototype. In-house costs exclude labor, hardware, and other overheads, which vary depending on circumstances.

With lead times reduced from days to hours, designers have more options:
1. Secure greater market share by reducing product development time, releasing products ahead of competitors
2. Maintain development timelines, but conduct more usability testing to enhance product quality
3. Balance these factors, decreasing development time and increasing the number of design iterations
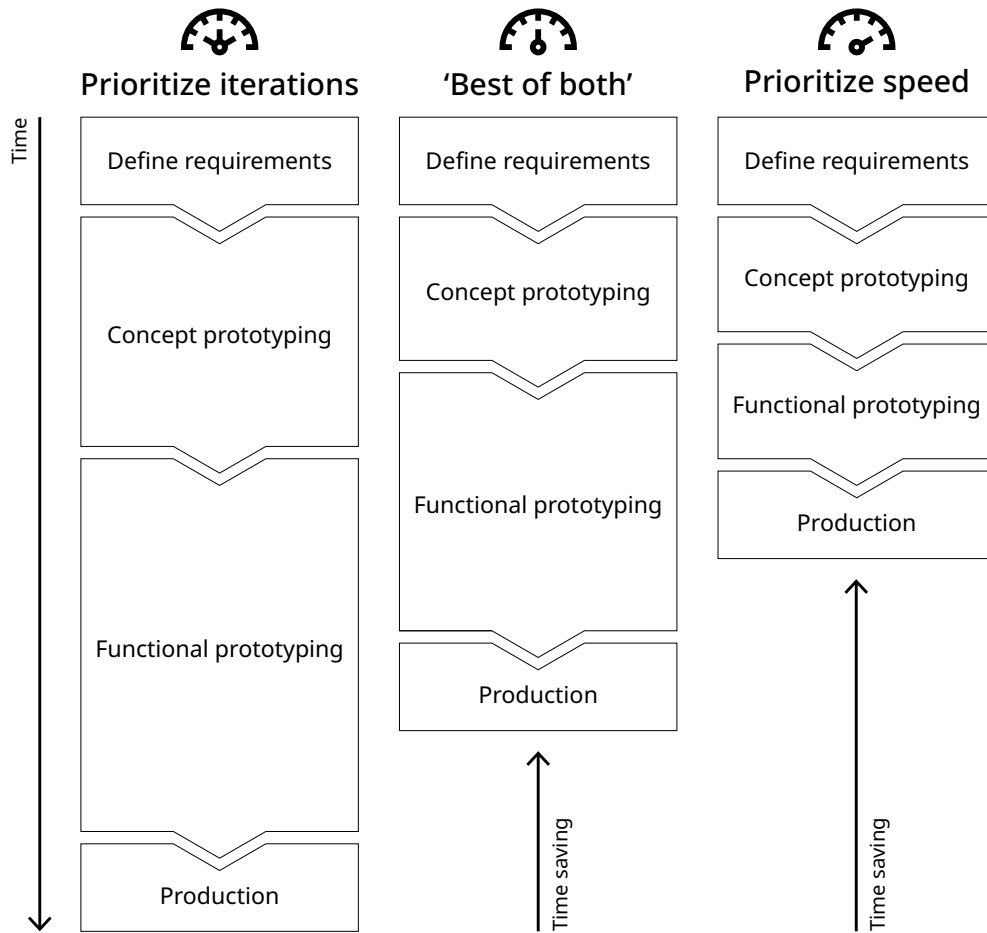
Design and software

Most 3D modeling software is capable of producing 3D printing file types, such as STL, 3MF, and OBJ files. Once design is completed, the 3D object is sent to slicing software that prepares the design for 3D printing. Ultimaker Cura includes plugins for specific 3D modeling suites (such as SolidWorks and Siemens NX) that enable direct 3D printing from CAD software.

As open source software, Ultimaker Cura enables businesses to develop customized plugins and share these with the community. The Ultimaker team also continuously improves the software, incorporating useful features from the community and ensuring optimal interoperability between your design software and 3D printer.

Ultimaker Connect enables the centralized management of multiple 3D printers via a Wi-Fi network, so you can manage print jobs, view print status via webcam, and access print analysis statistics. And with Ultimaker Cloud, you can back up your print settings to the cloud and print remotely from anywhere in the world.

Training and support is easily accessible, with manuals and video tutorials for Ultimaker Cura available on the Ultimaker website.

Materials

There is a wide range of cost-effective materials available for 3D printing that can be used for prototyping, tooling, and final part production. These include thermoplastics and composite materials. Dual extrusion 3D printing lets you combine different materials, to take advantage of their diverse properties.

The most commonly used material is PLA, which is ideal for producing prototypes quickly and reliably. This material is ideal for form and fit testing. With a dual extrusion 3D printer, such as those within the Ultimaker S-line, you can print PLA with PVA water-soluble support material to produce geometrically complex parts with minimal post processing.
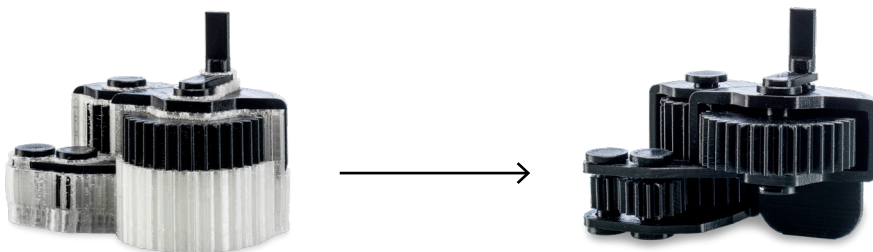
A print before and after PVA support material is removed

For highly functional mechanical prototyping there are industrial-grade material options, including ABS, nylon, polycarbonate, copolyester, polypropylene, and polyurethane. This provides a wide scope for prototypes with specific material properties such as chemical resistance, durability, dimensional stability, impact resistance, flexibility, or heat resistance.

Ensuring optimal use of these materials is easy with Ultimaker Cura's preconfigured 3D printing profiles. These have been developed and tested by experts to ensure the best print results with a specific material.

Ultimaker Cura's open filament system means that our printers are compatible with materials from various suppliers. Instead of being limited to the materials offered by your 3D printer manufacturer, you can use filaments such as composite materials from specialist material suppliers.

Setup and staffing

There are important business factors to consider when moving to in-house 3D printing. These include staff and training requirements, as well as logistical factors such as 3D printer placement and safety.

Personnel and resources

3D printing frees designers from traditional design constraints, but necessitates designing for additive manufacturing (DfAM).

To enhance staff's DfAM skills, you can contact your supplier or an independent third party for specialized training on how to design for FFF 3D printing.

Logistics

It is important to consider the environment in which your 3D printers will operate. Depending on the material printed, desktop 3D printers are considered clean and safe enough for an office environment, and are quiet enough to work alongside designers. But some materials, such as ABS, produce fumes that can be unpleasant.

The Ultimaker S5 Air Manager eliminates environmental concerns by filtering up to 95% of ultrafine particles (UFPs) emitted during 3D printing, with an operating sound of less than 51 dBA.

This makes it especially viable to place a 3D printer within the office environment. However, if you use multiple 3D printers, it may be preferable to place them in a separate space.

Networking and security
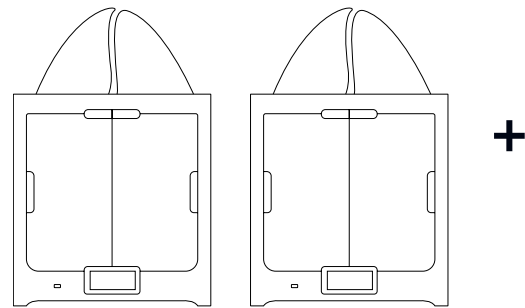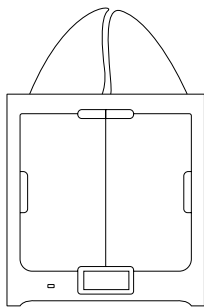
Single 3D printer for multiple users

Many companies start FFF printing with a single 3D printer, accessed by multiple users. This minimizes capital expense while allowing you to monitor cost and time savings.

It is common in such situations for the 3D printer to quickly exceed expectations, and for demand to exceed capacity. This is when many organizations begin to consider a multi- printer solution.

Multiple 3D printers for multiple users

Centralized 3D printers are easily managed via Ultimaker Connect, which allows users to send print jobs to multiple 3D printers on a Wi-Fi network. Print jobs are then automatically allocated to the next available printer with a matching material and setup profile.

Ultimaker Cloud enables remote printing, and allows users to save their preferred settings so that they are accessible from any location.

Operating 3D printers in the office

What can you expect once your 3D printers are up and running? If you have chosen the right 3D printer for your needs, any operational challenges should be avoided. Other factors will need to be considered though, such as planned maintenance and technical support.

Maintenance

3D printers need to be routinely maintained and cleaned to ensure optimum performance and lifespan. This applies to all components, particularly the extruder. Unless regularly cleaned and maintained, the nozzle can become blocked or damaged.

Regular cleaning of the build plate is also essential for optimal print adhesion. And periodic calibration of the build plate will ensure consistently accurate and reliable prints.

Staff should be able to conduct this simple maintenance, and should do so regularly to reduce downtime. Most 3D printer vendors will also supply a dedicated resource base aimed at maintenance and troubleshooting. Check that the manufacturer or vendor offers lifetime, fast-response support, as well as a warranty and spare parts.

Additional tools

To get the best from your desktop FFF 3D printer, there are a number of tools that form a handy maintenance toolkit. We suggest:

Spatula or palette knife
This is useful in cases where a 3D print is stuck to the build plate, or when you wish to remove a part before the plate has cooled. This can be done by gently easing the spatula under the print and carefully lifting it.

Screwdrivers and hex key screwdrivers
Hex nuts and bolts are widely used in 3D printer assembly, so it is wise to have a set of hex key screwdrivers and wrenches. These are used for tightening the gantry screws and stepper motors of your 3D printer.

Deburring tool, knife, or cutting pliers and cutting mat
A deburring tool cleans up modeled holes and removes small pieces of plastic from your printed parts. A knife and cutting pliers help to remove support structures.

Tweezers
Tweezers are useful for plucking oozing filament from the extruder nozzle before it starts printing and for cleaning up parts, post printing.

Adhesion sheets
Adhesion sheets are compatible with most materials, and boost adhesion to the build plate. They are easy to remove, can be used multiple times, and are developed to cope with high temperatures. It's important to check that the sheet is applied correctly, as any air bubbles will mean that the print surface is not flat.

Oil and grease
It is sometimes necessary to lubricate the X and Y axles of your 3D printer. Usually only a single drop of oil is needed for adequate lubrication. For the Z trapezoidal lead screw, grease may be a better option. Ultimaker 3D printers include both. Do not use spray lubricants, as this affects the axle coating and can damage the printer.

Glue stick
Covering the build plate with soluble glue can improve adhesion for some materials, with minimal effort or investment. (Always check the manufacturer's material advice.)

Digital caliper
A digital caliper can be used to check the precision of your prints, and to measure part dimensions to replicate in CAD software.

Find out whether your manufacturer or vendor offers a starter kit or add-on pack, in addition to what is provided in your 3D printer box.

Explore more 3D printing knowledge

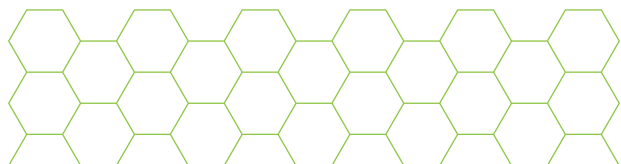Learn more from industry leaders and experts, or request a quote, on the Ultimaker website.

Read more 3D printing resources

Request a quote
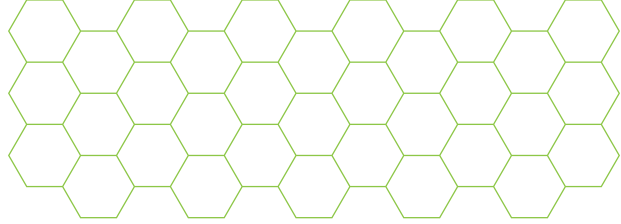
About Ultimaker

Since 2011, Ultimaker has built an open and easy-to-use solution of 3D printers, software, and materials that enables professional designers and engineers to innovate every day.
Today, Ultimaker is the market leader in desktop 3D printing. From offices in the Netherlands, New York, Boston, and Singapore – plus production facilities in Europe and the US – its global team of over 400 employees work together to accelerate the world's transition to local, digital manufacturing.

ultimaker.com

General inquiries: info@ultimaker.com
Find a local reseller: ultimaker.com/resellers

Ultimaker