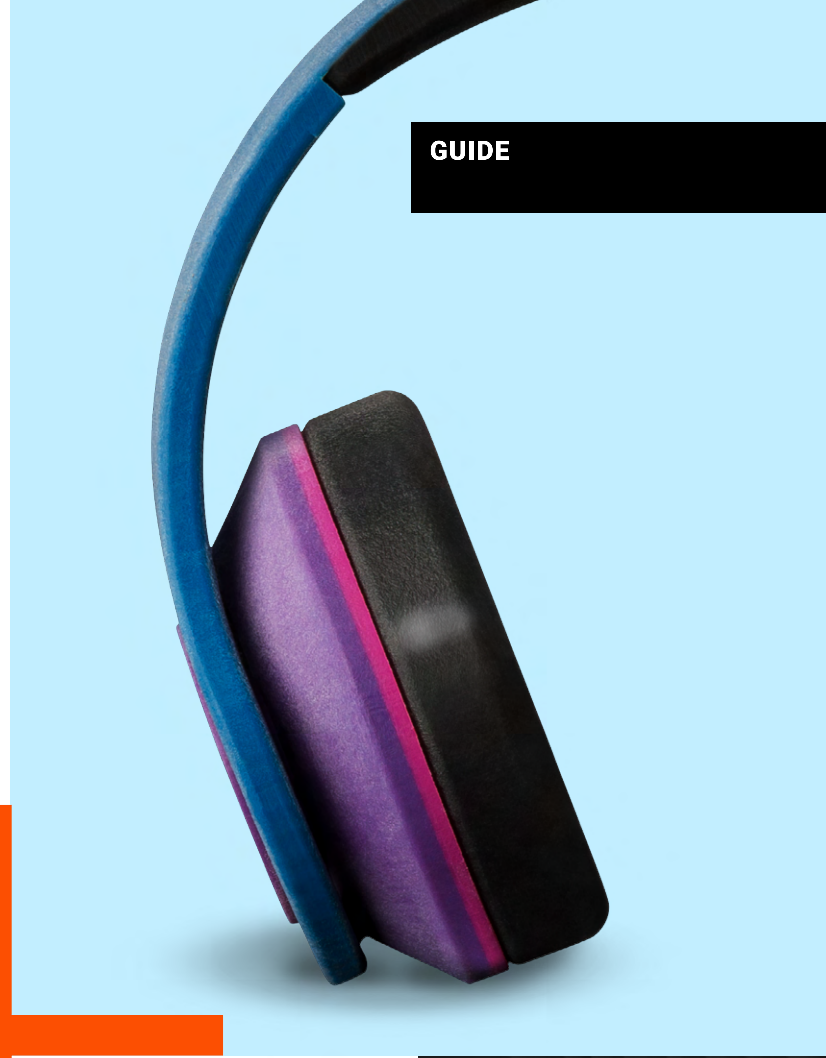
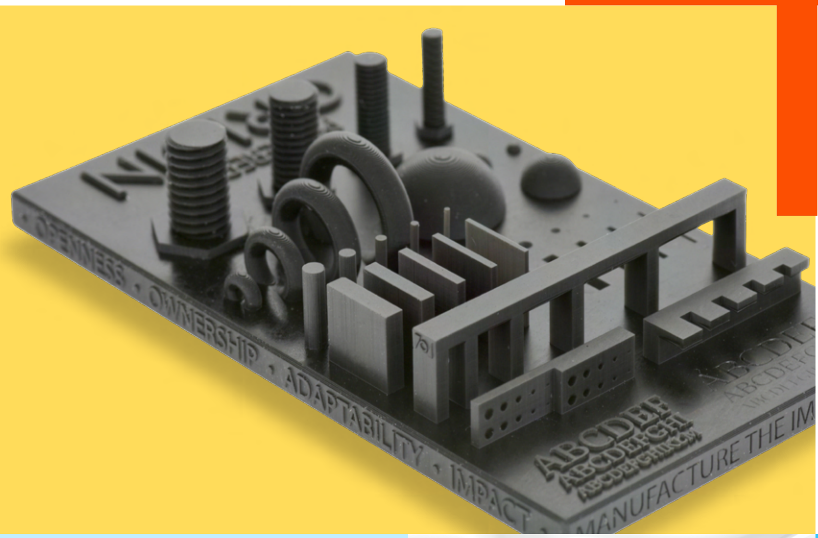
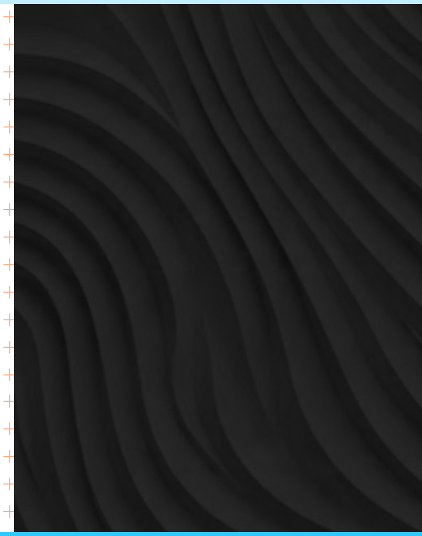
GUIDE

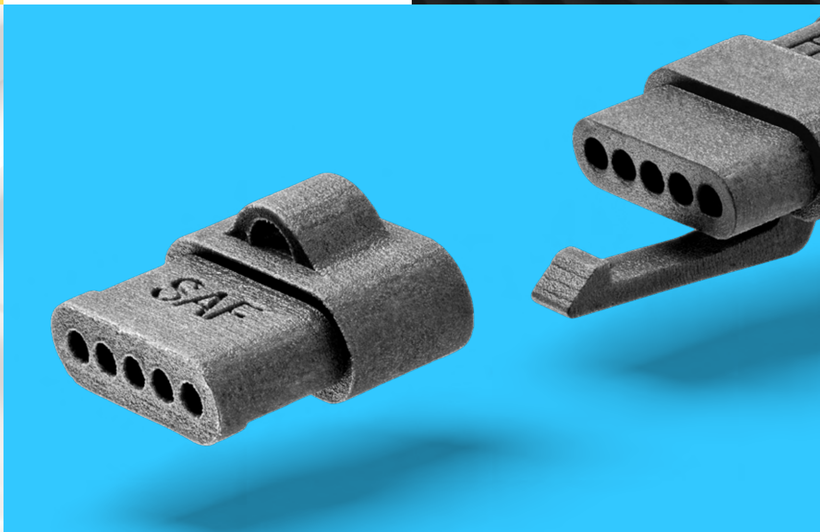
3D Printing
Guide 2025

Find the best technology, printer, and materials for your business.









Contents

What is 3D printing?

3D printing is a process that creates three-dimensional objects from a digital model. It's often called additive manufacturing (AM) because the objects are built by adding successive layers of material, one on top of the next. Conventional manufacturing uses subtractive methods where the desired shape is created by cutting material away from a solid block. 3D printing is less wasteful because material is only added where it's needed to create the part.

A 3D printer is the machine that builds the part. 3D printers differ based on the type of printing technology used and the size of the parts they can build. To make the part, the printer gets its "instructions" from a CAD model and software "slices" the CAD model into virtual layers. The printer then applies material where it's needed to build each layer until the object is completed.

Do More in Less Time

From rapid prototyping to manufacturing to realistic medical modeling, 3D printing opens the door to increased efficiencies and broader business opportunities. 3D printing frees you from traditional manufacturability constraints because your designs aren't limited by the restrictions of conventional machine and mold tools. You can make things that often can't be made at all with conventional tools, so you can optimize and create prototypes, tools, medical models, and functional parts much more quickly and for a lower cost.

Find Your Perfect 3D Printer

As you begin your search for the right 3D printing solution, this guide will help you understand the questions you'll need to ask as well as provide insight into the technologies, materials and services available to you.

> "The adoption of 3D printing as an engine for growth and innovation is reaching levels where the potential for disruption is becoming very real."

Questions to Guide Your Research

What is your goal?

Stratasys professional 3D printing encompasses multiple technologies and capabilities along with a wide range of materials. Being clear about your goals will help you zero in on the right solution. Some objectives you might consider include:

- Shorten the design cycle
- Test more design ideas in less time
- Illustrate ideas to colleagues or investors more clearly
- Improve customization for products already produced
- Produce functional prototypes to catch and correct errors earlier
- Develop job-ready students for tomorrow's technical careers
- Improve patient outcomes using realistic surgical planning models
- Improve medical simulation and clinical training programs

What will you do with the parts you print?

Will they simply communicate an aesthetic concept (form and fit)? Or, do they need to function like traditional production materials (form, fit and function)? Will your printed parts be the final production components? Your answers to these questions will go a long way toward helping you choose the best printer fit.

Are aesthetics more important to you than functionality?

Do your models need to look realistic? Do you need clear, multiple color or rubber-like materials? Do you need to be able to print models that have rigid and flexible elements? Do you need high fidelity for a smooth surface finish and the ability to print small features? If attaining these aesthetic characteristics with minimal post processing is most important to you, PolyJet, SL and P3 printers should be top considerations.

Where will your printed parts be used?

Will they need to stand up to heat or pressure? Will they be used outdoors and need UV resistance? Will they be exposed to chemicals? Do they need to be able to withstand high temperatures? Do they need to be chemical-resistant? Do they need to hold tighter tolerances? Do they need to be biocompatible or sterilizable for the medical field? If functional performance is critical for you, FDM® printers that print durable thermoplastics are an excellent choice. SAF and P3 printers also print with extremely robust materials. PolyJet and P3 offer bio-compatible materials specifically designed for the healthcare industry.

How long do you need your printed parts to last?

Will you use the parts one time, or will they need to withstand repeated use? If you need longevity from your printed parts, FDM, SAF and P3 printers will likely be the best technological fits for your organization. The robust materials these printers utilize print parts that can maintain their mechanical properties.

What skills do you have in-house?

Depending on the specific 3D printing technology you choose, some orientation and training may be required. For FDM and PolyJet technologies, Stratasys offers training online or in person through instructor-led courses, webinars, and e-learning modules.

If you don't have the resources to manage a lab, or the expertise to operate or design for a certain technology, outsourcing production is a good way to minimize risk and learn more before dedicating permanent resources.

What type of work do you have?

Some systems are more office-friendly than others, but even if you don't have the floor space or the ventilation requirements, you can still take advantage of the more demanding technologies through service bureaus like Stratasys Direct that can provide 3D printing services.

What is your budget and timeline?

If you have a project with a predetermined budget and timeline, you may just be looking for the fastest solution at the lowest cost. Purchasing parts through a service bureau might be your best option.

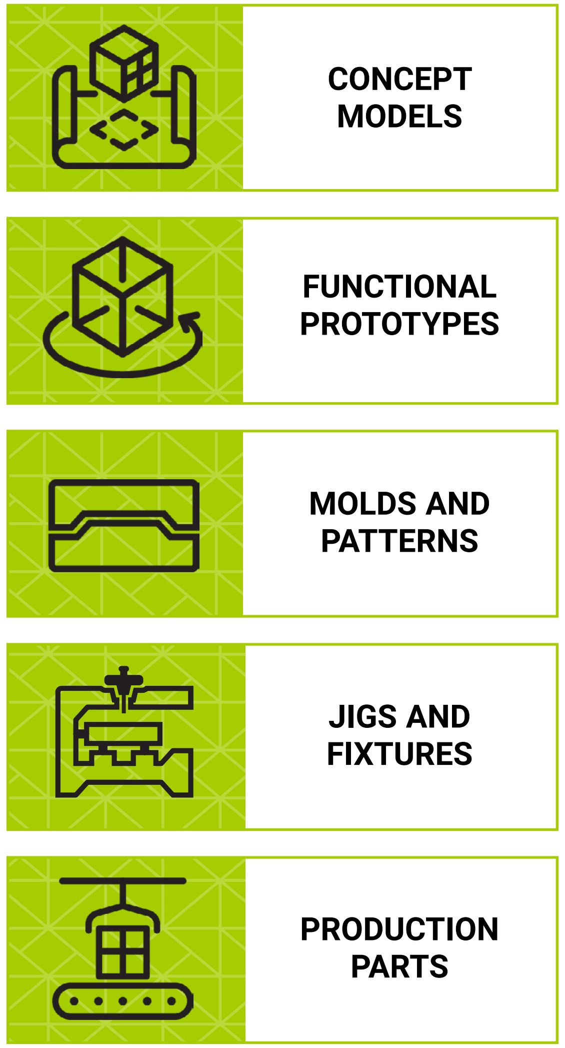
Stratasys Technologies

Stratasys offers a range of 3D printing technologies, so you can find the right fit for your needs. Use the following sections to better understand how each 3D printing technology works, where it excels, and what materials are available.

FDM Technology

FDM systems and related technologies are by far the most accessible and widely used form of 3D printing. 3D printers based on FDM technology build parts layer by layer from the bottom up by heating and extruding thermoplastic filament.

Production-level systems can work with a range of thermoplastics with specialized properties like toughness, electrostatic dissipation, translucence, biocompatibility, UV resistance and high-heat deflection. This makes FDM ideal for a variety of applications ranging from basic proof-of-concept models to functional prototypes to lightweight ductwork on commercial aircraft.



Compatible materials

- Standard thermoplastics
- Engineering thermoplastics
- High-performance thermoplastics

Synonyms and similar technologies

- Filament extrusion
- Fused-deposition modeling
- Fused-filament deposition
- Fused-filament fabrication
- Material deposition

Training requirements

Knowledge of build setup, minor maintenance, machine operation, and finishing.

Facility requirements

Any air-conditioned environment and a dedicated space with ventilation and compressed air for larger 3D production systems that process engineering and high-performance plastics.

Ancillary equipment

Support removal system and optional finishing system.

> Since having the F770 here, it has allowed us to progress designs much quicker. We can go from the conceptual phase to the tooling phase in weeks, which would normally take months. Its speed means we can develop a product concept in a day, print it overnight, come in the next day and its ready.

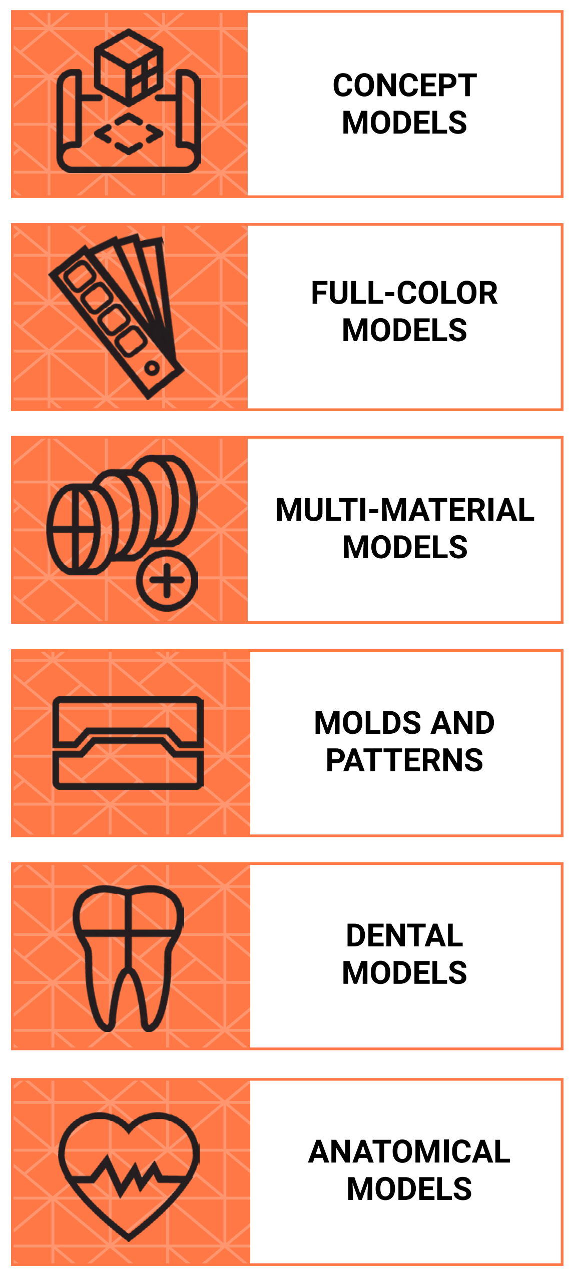
Luke Davis
Design Engineer, Loadhog

PolyJet Technology

PolyJet technology is renowned for its outstanding realism and breathtaking aesthetics. The technology works similarly to traditional inkjet printing, but instead of jetting ink onto paper, a print head jets liquid photopolymers onto a build tray where each droplet cures under ultraviolet (UV) light.

Every PolyJet 3D printer offers sharp precision, smooth surfaces and ultra-fine details. And by combining a variety of photopolymers in specific concentrations and microstructures, the most sophisticated PolyJet systems can simulate everything from thermoplastics and rubber to human tissue, in a broad gamut of colors.

Product designers use PolyJet technology to make models and prototypes with final-product realism to quickly gain critical feedback from clients, investors and other stakeholders. PolyJet's versatility also makes it an optimal choice for specialized applications including surgical planning models for simulation and training, and dental fixtures and appliances.



Compatible materials

- Full-color photopolymers
- Clear photopolymers
- Flexible photopolymers
- High-impact photopolymers
- Photopolymers that mimic human anatomy

Synonyms and similar technologies

- Multijet printing
- Photopolymer jetting

Training requirements

Knowledge of build setup, minor maintenance, machine operation and finishing.

Facility requirements

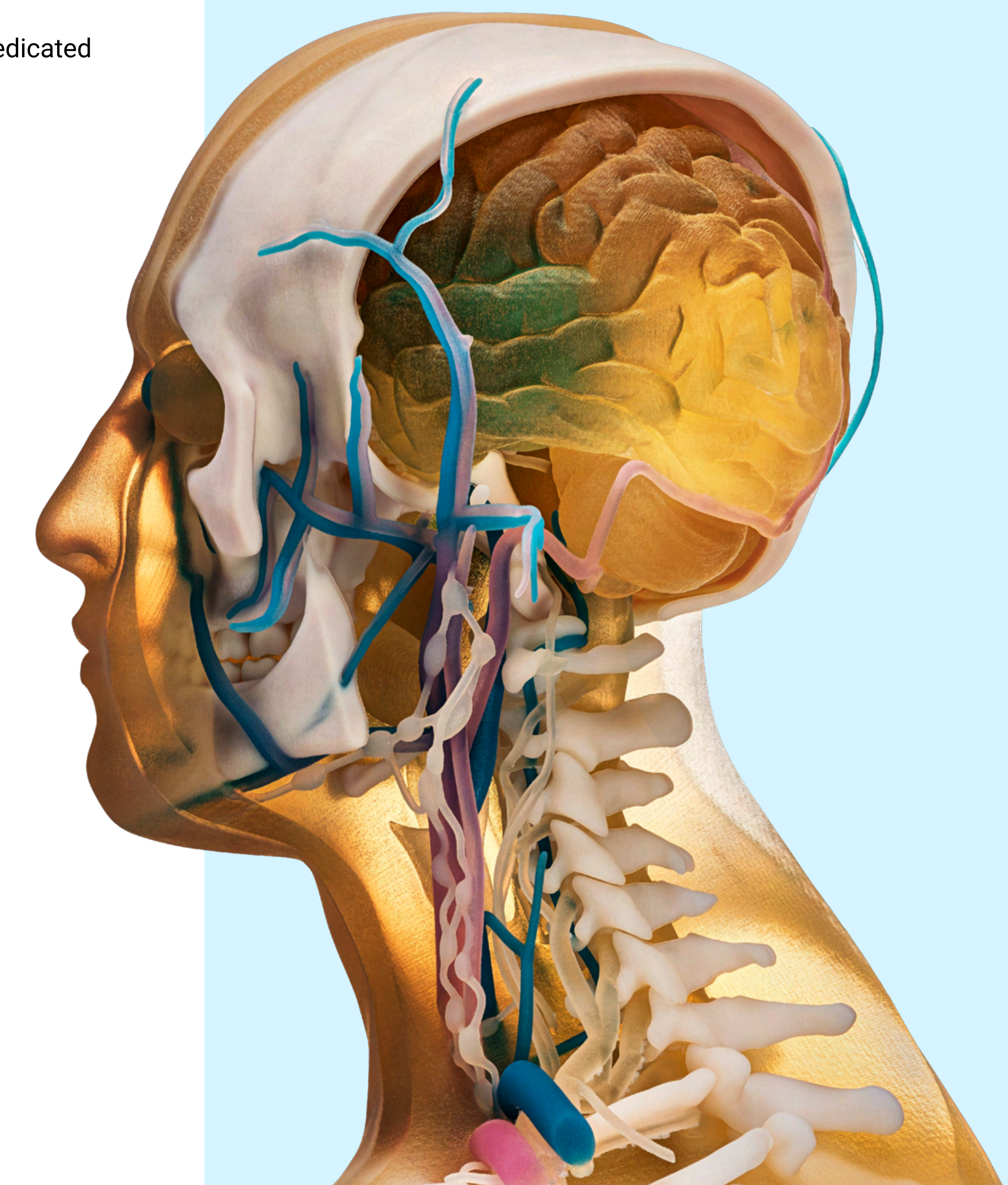
Any air-conditioned environment and a dedicated space for larger systems.

Ancillary equipment

Support removal system.

> If we were making a scale model with traditional processes, it would probably cost us over £1,000. That would probably cost us a couple of £100 to do on the printer. The cost saving there is massive.

Neil Walker
Managing Director, Penta Patterns



Selective Absorption Fusion™ Technology

Selective Absorption Fusion™ (SAF™) technology on the Stratasys H350™ delivers functional, production-grade 3D printing with unmatched consistency. Ideal for high-volume, short-run production, SAF technology achieves accuracy and repeatability by jetting single or multiple drops of highly loaded fluids with fine detail or large, fused areas without compromising throughput.

Thanks to its unique in-line unidirectional architecture, SAF technology prints, fuses, recoats (with Big Wave™ powder system), and heats powder in the same direction. The time-controlled manner of these processes ensures part consistency and a uniform thermal experience across the whole bed. As a result, SAF-based products will deliver a competitive cost per part, production-level throughput, part quality and consistency, and a high production yield.

PRODUCTION LEVEL

CONCEPT MODELS

JIGS AND FIXTURES

FUNCTIONAL PROTOTYPES

Compatible materials

- Powdered thermoplastics

Synonyms and similar technologies

- Selective Absorption Fusion™ SAF™
- Multi-Jet Fusion (MJF)
- Selective Laser Sintering (SLS)

Training requirements

Knowledge of build setup, minor maintenance, machine operation, and finishing.

Facility requirements

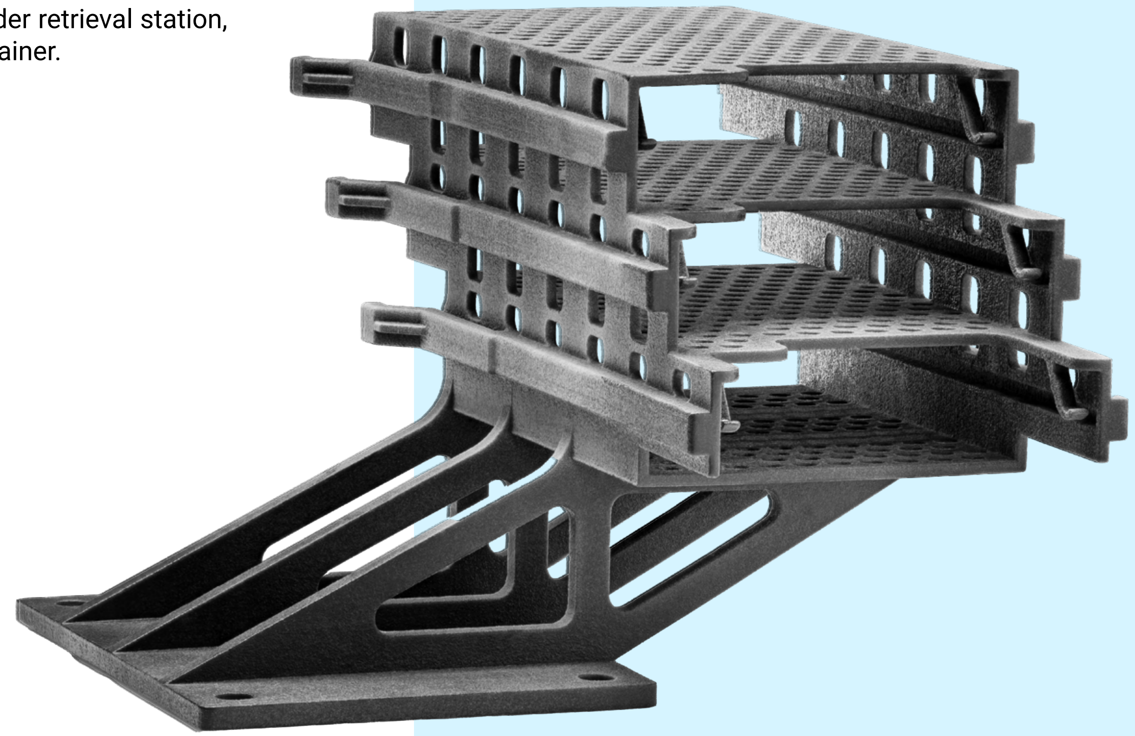
- A temperature- and humidity-controlled environment and a dedicated space for a larger system
- Power requirements: 3P+N, PE, 50 – 60 Hz, 16A
- Power consumption: 3.25 kW, 5 kw (peak), 0.15 kW (idle)
- Network requirements: RJ45 ethernet connection 35MBit
- Network with DHCP server and internet access

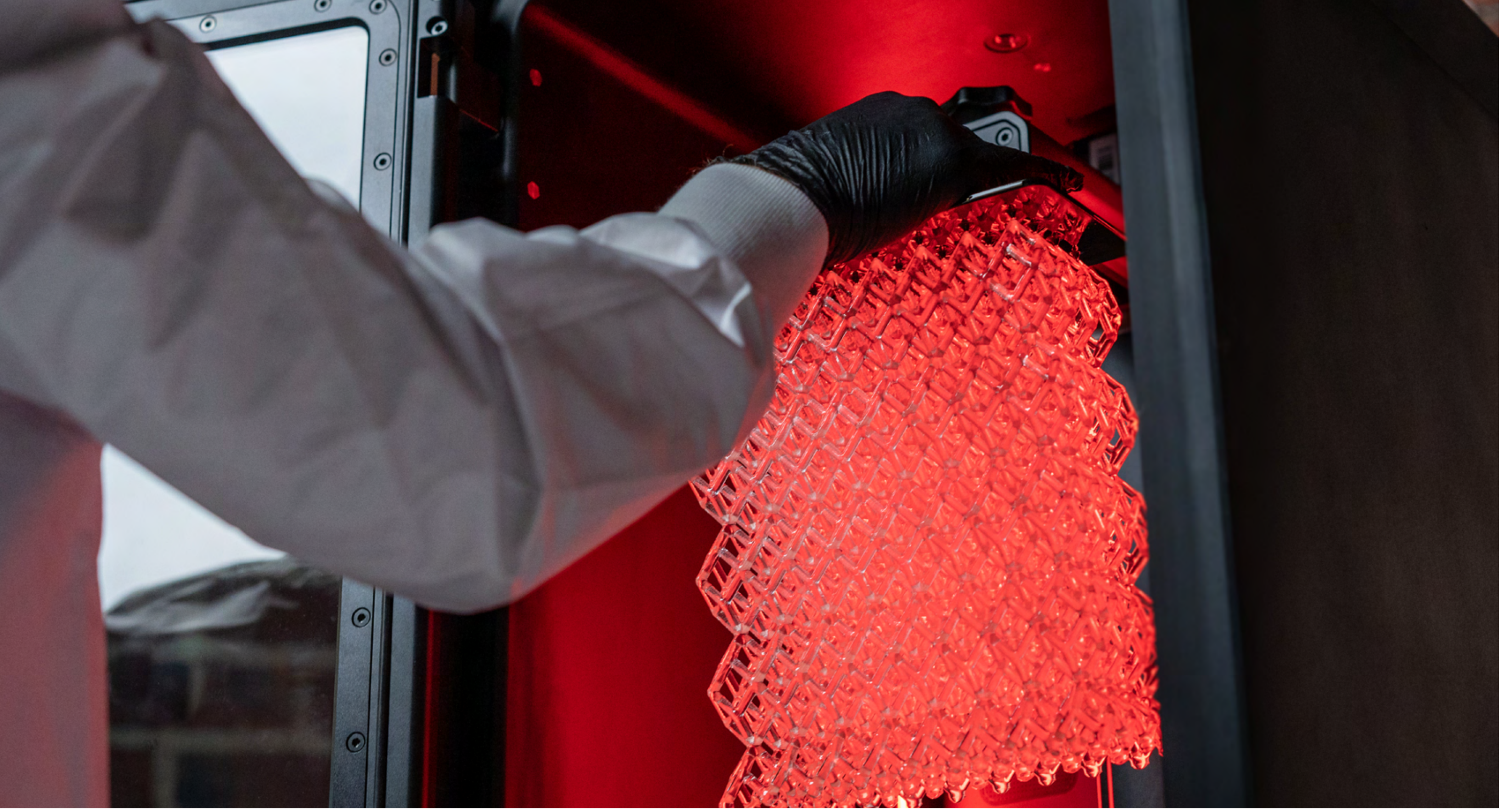
Ancillary equipment

Build removal box, powder retrieval station, trolley and powder container.

“

The H350 3D printer provides us with a strong solution for volume production to manufacture cost-effectively and in short lead times.”





Programmable PhotoPolymerization (P3™) Technology

Programmable PhotoPolymerization (P3) technology is all about high-performance materials, accuracy, part quality, and ensuring that the last part is identical to the first. Used with Origin® 3D printers and the Origin One Dental, P3 technology helps you launch faster and respond flexibly to shifts in demand so you can expand production without delays — all while maintaining minimal inventory. You'll reduce part count, simplify your workflow, and improve product performance.

P3 technology delivers exceptional accuracy, consistency, and isotropy. You can print details less than 50 microns in size with high-accuracy materials, and you'll get smooth surface quality without secondary finishing, sanding, painting or additional processing. You'll have a lot of design flexibility, too, with a wide range of single-component, commercial-grade photopolymers to choose from.

MOLDS AND PATTERNS

JIGS AND FIXTURES

PRODUCTION LEVELS

FUNCTIONAL PROTOTYPES

DENTAL PARTS

Compatible materials

- Choose from a wide range of single component production materials, including:
  - Heat-resistent
  - Tough
  - General purpose
  - Elastomers
  - Medical-grade
  - Biocompatible
  - Digital Light Processing (DLP)

Synonyms and similar technologies

- Programmable PhotoPolymerization
- P3
- Carbon Digital Light Synthesis™ (Carbon DLS™)
- Continuous Liquid Interface Production (CLIP)

Training requirements

Knowledge of build setup, minor maintenance, machine operation, and finishing.

Facility requirements

- A temperature- and humidity-controlled environment
- Operating temperature: 15 – 30 °C (59 – 86 °F)
  Operating Humidity: 30 – 70%
- 90 – 264 VAC, 50 – 60 HZ, 700 W, 1 phase
- Ethernet / WiFi with secure network configuration
- Resin storage: typically 15 – 30 °C (59 – 86 °F)

Ancillary equipment

- Support removal: Branson Sonicator available to order from Stratasys
- Post-curing: Dymax UV flood lamps available to order from Stratasys

"Once we're happy with a product, we don't have to go and get any injection mould tooling or anything. We can literally produce a part, with a little bit of post-processing, insert all the parts we need to and then ship it out. That was the revolution we were after and now we have achieved it."

Simon Perrett
Head of Research & Development, Spectra Group

"What we find with the Origin One Dental is that we can rely on the repeatability of quality and accuracy for our guides and models."

Neil Appelbaum
Managing Partner,
Protec Dental Laboratories

Technology Comparison

Each Stratasys 3D printing technology solves specific design and manufacturing challenges. Use the following comparisons to further understand the characteristics and differences between FDM, PolyJet, SL, SAF, and P3.

FDM Technology

Layer Resolution GOOD	● ●
Thin Walls GOOD	● ●
Surface Finish VERY GOOD	● ● ●
Ease of Use EXCEPTIONAL	● ● ● ● ●
Product Development Application Versatility EXCEPTIONAL	● ● ● ● ●

Strengths

Durability, reliability, easy support removal, office-friendly operation, wide range of thermoplastics commonly used in production applications — some advanced materials are certified

Weaknesses

Visible layer lines, anisotropic strength (weaker along layer lines)

PolyJet Technology

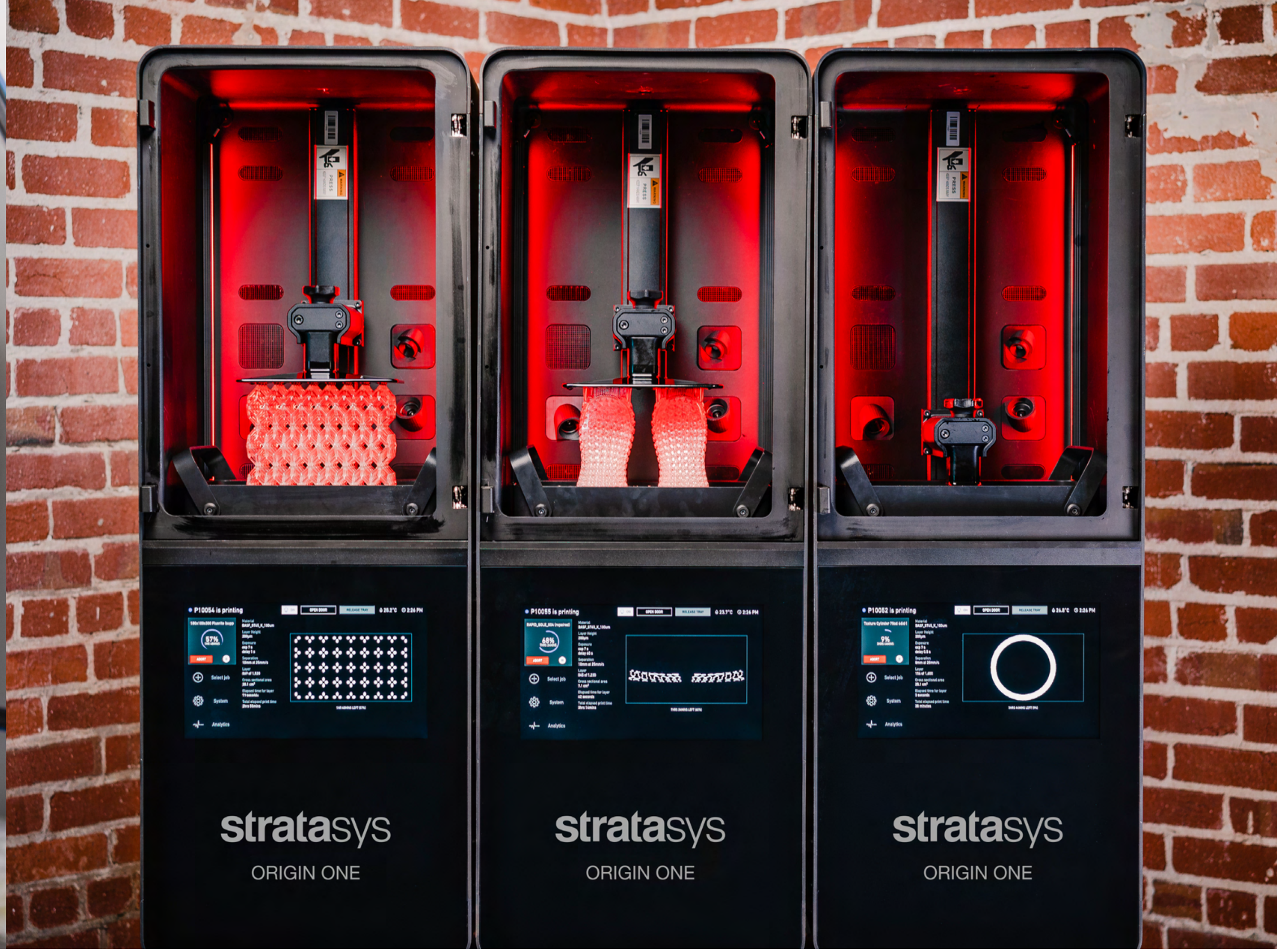
Layer Resolution EXCEPTIONAL	● ● ● ● ●
Thin Walls EXCEPTIONAL	● ● ● ● ●
Surface Finish EXCEPTIONAL	● ● ● ● ●
Ease of Use EXCELENT	● ● ● ●
Product Development Application Versatility VERY GOOD	● ● ●
Anatomical Presets EXCEPTIONAL	● ● ● ● ●

Strengths

Part realism, surface finish and feature resolution, easy support removal, office-friendly operation, multi-color printing, clear materials, multi-material printing (overmold printing — flexible and rigid materials in one continuous part print) accurately mimicking biomechanical tissue properties

Weaknesses

Temperature sensitive, limited functional material properties



SAF Technology

Layer Resolution VERY GOOD	● ● ●
Thin Walls VERY GOOD	● ● ●
Surface Finish VERY GOOD	● ● ●
Ease of Use GOOD	● ●
Product Development Application Versatility EXCELLENT	● ● ● ●

Strengths

Part durability, accuracy and consistency, cost effective in higher volumes

Weaknesses

Limited materials, lower volumes not as cost effective, not optimal for conceptual prototyping

P3 Technology

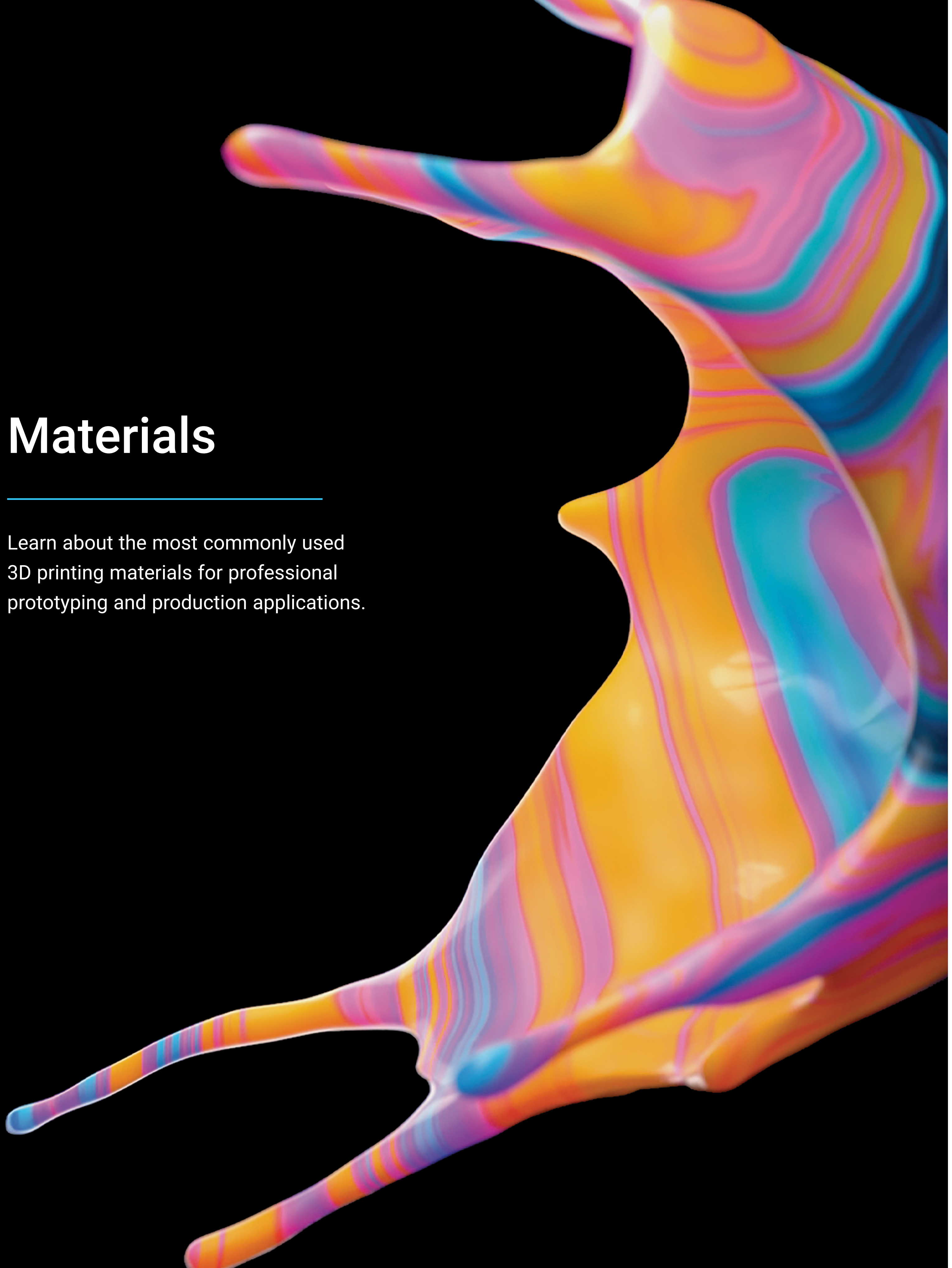
Layer Resolution EXCELLENT	● ● ● ●
Thin Walls EXCEPTIONAL	● ● ● ● ●
Surface Finish EXCELLENT	● ● ● ●
Ease of Use EXCELLENT	● ● ● ●
Product Development Application Versatility EXCEPTIONAL	● ● ● ● ●

Strengths

Rigid and flexible materials, surface finish, part strength, biocompatible materials, high throughput, low cost per part, UV stability

Weaknesses

Extra post-curing steps, limited build envelope size, not optimal for office settings



Materials

Learn about the most commonly used 3D printing materials for professional prototyping and production applications.

Thermoplastics

Standard plastics

The most widely used category of 3D printing materials includes some of the same general-purpose plastics found in mass-production processes like injection molding. And since 3D printed parts bear many similarities to their injection-molded counterparts, you can accurately test form, fit, and function before investing in expensive tooling.

Engineering plastics

For applications that require higher heat resistance, chemical resistance, impact strength, fire retardancy or mechanical strength, production-level 3D printers work with specialized plastics that meet stringent engineering requirements.

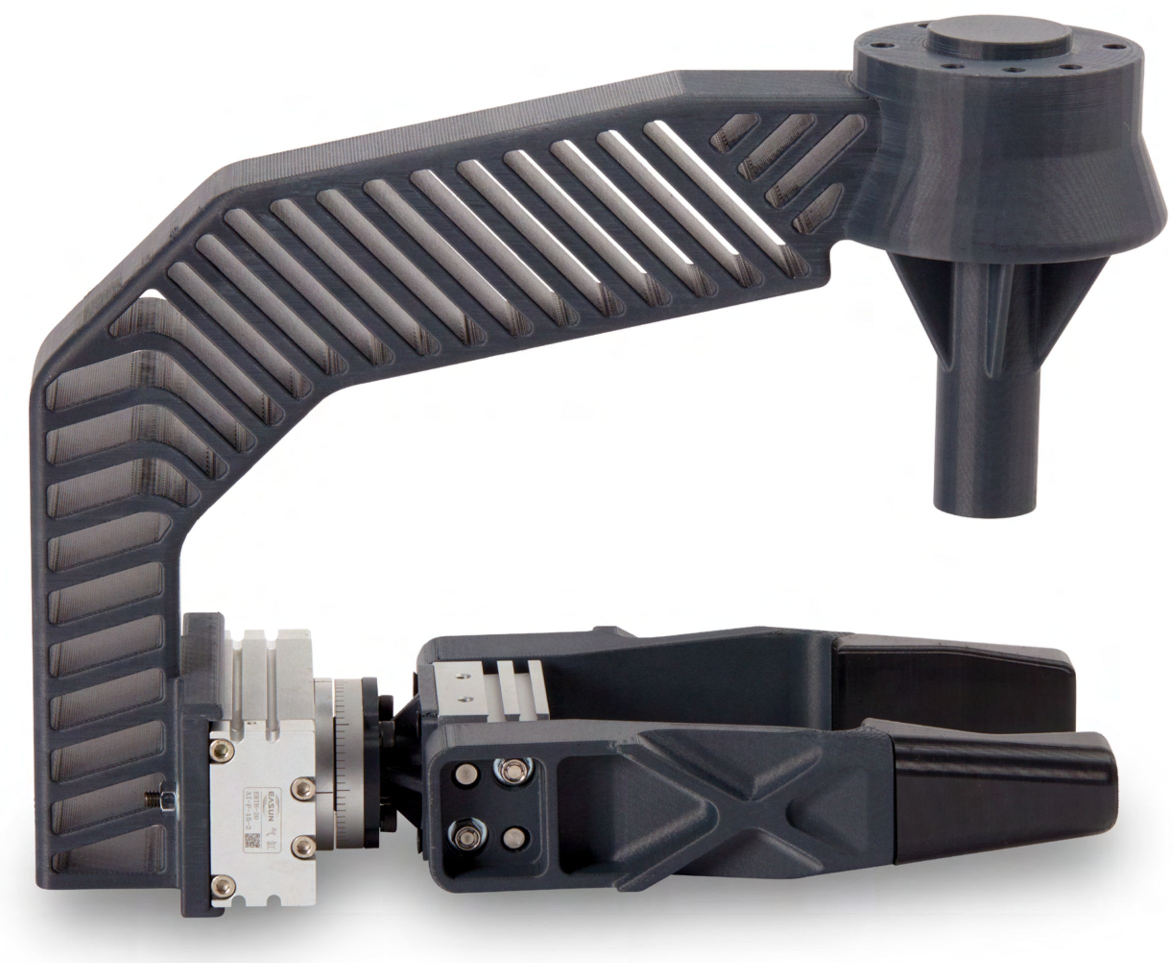
High-performance plastics

High-performance plastics offer the greatest temperature stability, chemical stability and mechanical strength for the most demanding applications.

Printing methods

FDM

SAF



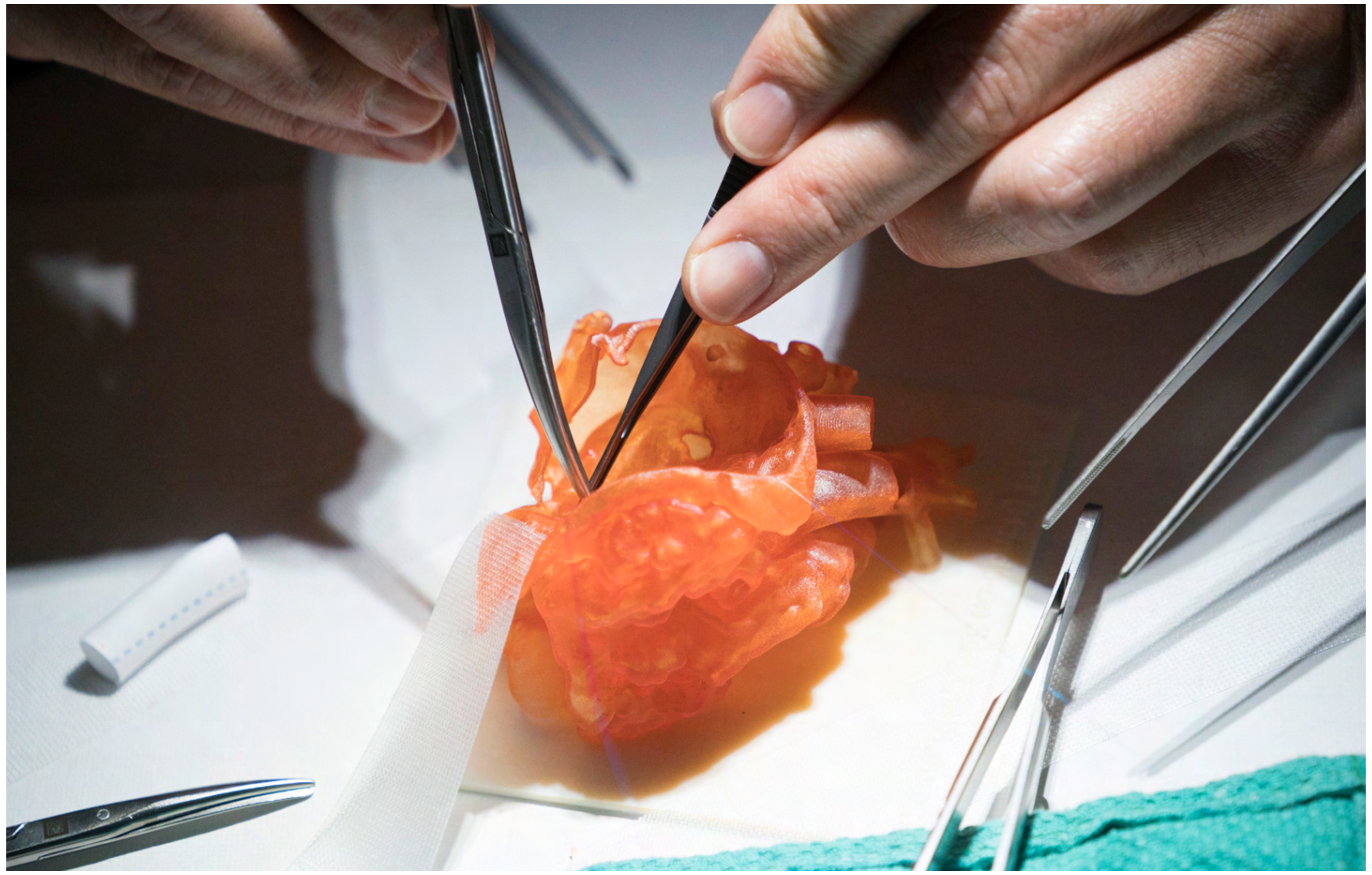
Photopolymers

Photopolymers are liquid resins that cure with exposure to UV light. Most photopolymer technologies print single, opaque colors like grey, white and black. Many of them also have translucent or clear materials. PolyJet is even more advanced and is capable of printing models with full and gradient color and tissue mimicking properties. Generally speaking, photopolymer technologies produce models with outstanding feature definition and a smooth, beautiful surface finish. Some, like SL, have a specially formulated material for investment casting patterns. However, photopolymers are UV-sensitive and generally not as durable as production-grade thermoplastics.

Printing methods

PolyJet

P3



Cost of Ownership

If you're considering bringing 3D printing in-house, learn about the factors that contribute to the total cost of ownership.

The Six Cost Factors

3D printer

Stratasys professional 3D printers range in price depending on capability. Consider your current and future 3D printing goals to determine an appropriate printer choice.

Materials

The cost of materials and the amount you'll consume will be a big contributor to your total cost of ownership. If you don't need high-performance thermoplastics or full-color multimaterial capability, lower-priced printers will be your best option.

Equipment and facilities

FDM, PolyJet and P3 3D printers can be installed in any office environment, while SL and SAF printers have special requirements.

Labor

All FDM and PolyJet printers are easy to use and don't require extensive training. SL, SAF, and P3 printers may require more training and/or the need for personnel trained in this type of 3D printing technology.

Support and maintenance

An annual service contract can help minimize downtime, maintain production schedules, and keep costs stable and predictable.

The cost of doing nothing

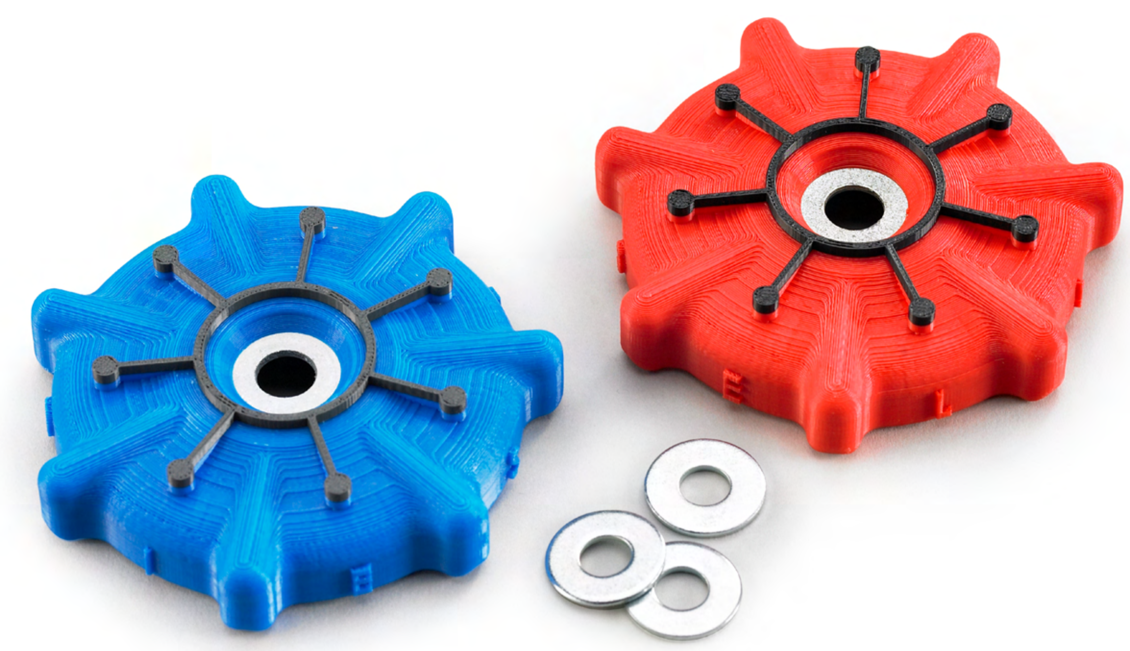
Show decision-makers the cost of inaction — whether that's slow design and decision processes, too many change orders, a stagnated product line or excess inventory with fewer turns.

> "For our first FDM machine purchase, we projected ROI in 4 years, but it took only 18 months. For our second FDM machine purchase, we saw ROI in only 9 months."
>
> **Mitchell Weatherly**
> Sheppard Air Force Base

Cost Comparison

	Under $10K	$10 – 50K	$50 – 200K	$200 – 500K
FDM Printer	●	●	●	●
PolyJet Printer		●	●	●
SAF Printer				●
P3 Printer			●	

	Material Costs	Time and Labor Requirements	Facilities and Equipment	Printed Part Cost* Economy of sale for mass-production
FDM Printer	$$	$	$	$$$
PolyJet Printer	$$$	$$	$$	$$$
SAF Printer	$$	$$	$$$	$
P3 Printer	$$$	$$$	$$	$$



*Excludes capital expenditure hardware investment costs

Endless Possibilities for any Industry

Personalized Healthcare

Doctors today use 3D printed medical models to practice procedures as well as explain the procedure to patients and families. In addition, medical device companies use 3D printing to prototype new, life-saving products and train doctors on new procedures. Lastly, dental labs use 3D printing to produce dental models, surgical guides, soft splints, dentures, and more.

High-performing Factories

Today, 3D printing is improving the performance of factories around the world with helpful tooling, jigs, and fixtures that increase speed of production while increasing quality and employee safety. Some companies are also using it as a replacement for injection molding.

Compressing Product Development Time

With 3D printing, companies are getting their products to market faster with the help of functional prototypes. They are even skipping the 2D drawing step and going straight to 3D printed prototypes. With the addition of PolyJet and PANTONE color matching, designers can make realistic prototypes that look and feel like real objects.

Modern Supply Chain

With 3D printing, injection molding can sometimes be replaced. In addition, the benefits of inventory reduction are gained by 3D printing's capability for low- to mid-volume on-demand production.

Expert Help is Always Available

As an authorized reseller we are ready to help you find the ideal 3D printing solution for your organization based on your applications, budget and timeline.

Discover our solutions:
www.sys-uk.com

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