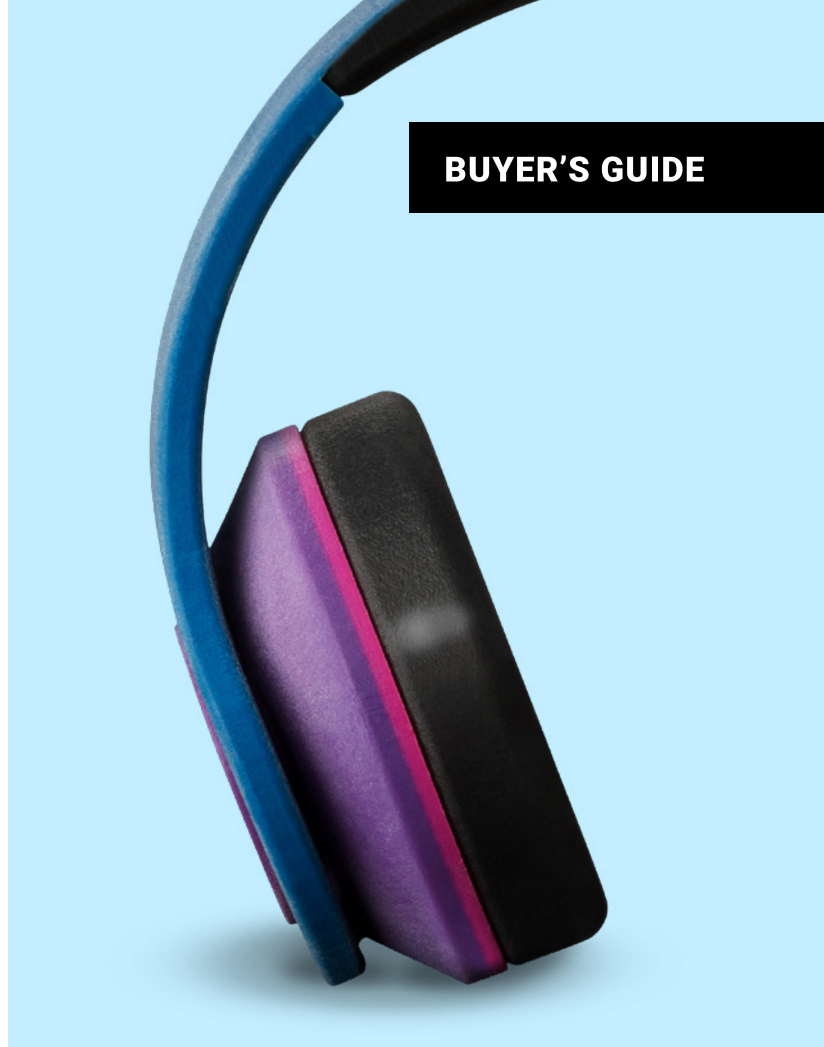
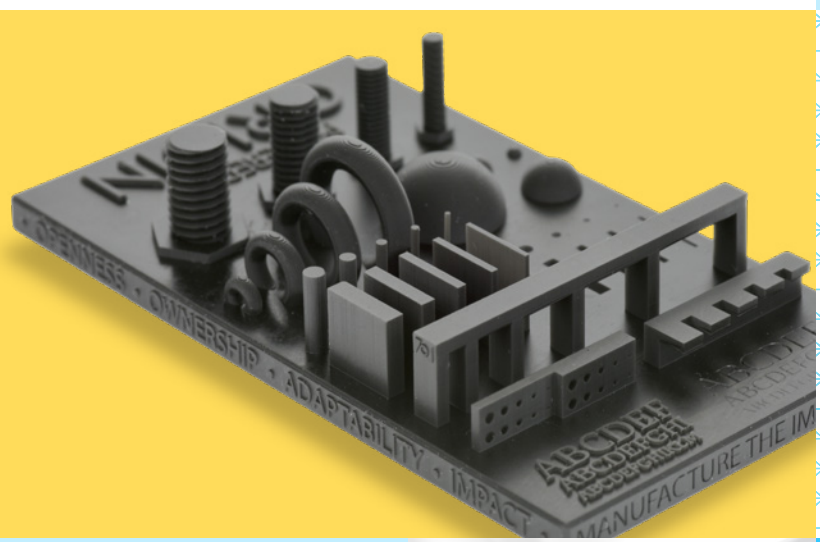
stratasys

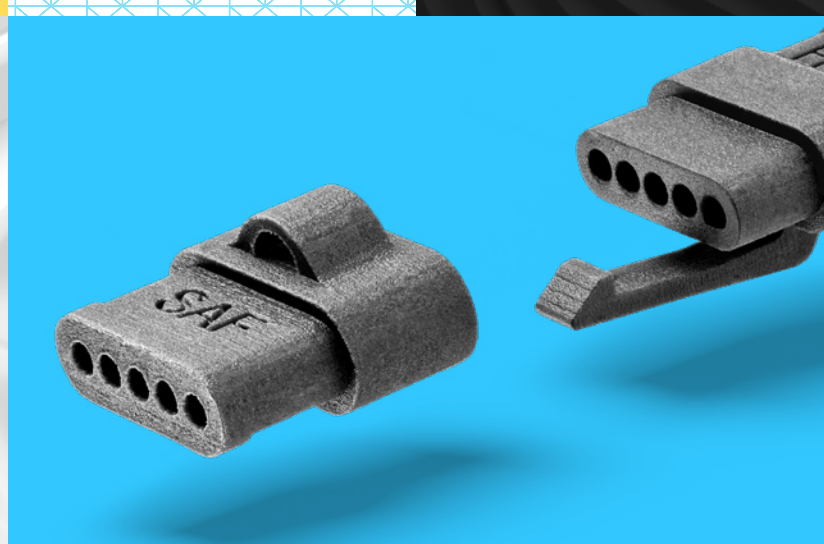


BUYER'S GUIDE

3D Printing Buyer's Guide

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





Contents

An Introduction to Additive Manufacturing

Additive Manufacturing (AM), also referred to as 3D printing, encompasses a range of processes that build three-dimensional parts from a digital model by adding successive layers of material, one on top of the next. This is in contrast to conventional manufacturing processes, such as machining, that cut material away from a solid block to achieve the required shape.

AM's evolution over the last four decades has witnessed significant technological advances that have taken it from a prototyping tool to a competitive industrial tool for production parts. It is important to understand that it is not an either/or choice however, as prototyping remains a significant AM application. Rather, developments in AM hardware, software, and materials are enabling new opportunities to produce complex and customized end use parts at higher volumes.

A 3D printer is the machine that builds the parts. 3D printers differ based on the type of printing process used. There are pros and cons for each process, which this document will help you address to find the right one for your application(s). However, all additive processes are similar in their digital approach to manufacturing. In order to make the part, the printer gets its "instructions" from a digital 3D CAD model, and dedicated software "slices" this model into virtual layers that inform the printer where to apply the material to build the part.

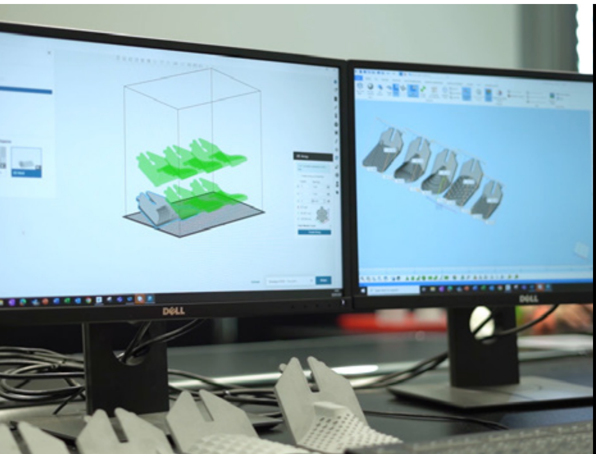
The software that powers these printers is equally crucial to successful additive manufacturing. Advanced software solutions transform 3D printers from standalone machines into integrated production systems that can be efficiently added to your workflow, run at optimal performance, and scaled as your needs grow. From preparing files for printing to managing multiple machines and analyzing production data, the right software ecosystem is essential for maximizing the value of your additive manufacturing investment.

For prototyping applications, 3D printers offer countless advantages for product development engineers and designers. Shorter lead times, more iterations, and higher quality have resulted in greater adoption of additive manufacturing for prototyping across virtually every industrial sector imaginable. Beyond prototyping however, AM systems have evolved significantly, to the extent that manufacturers routinely use them for tooling and production applications. These AM systems now provide a viable option for more manufacturing applications, especially for complex designs that are limited by the restrictions of conventional machine and mold tools.

How to Find the Right Additive Manufacturing Solution

Stratasys additive technologies provide a complete solution-based approach for a wide range of challenges affecting industries and fields from manufacturing to education to health care. The combination of printers, materials, software, and service gives you many options to address the problems you want to solve. The right solution depends on a variety of factors related to your business, your goals, and your desired outcomes.

This guide is intended to help you understand the questions you'll need to ask to find the right AM solution for your application. It will also provide insight into the available Stratasys AM technologies, materials, and services, and the advantages they offer that can help you achieve your goals. The next section will help you clarify your needs and goals to make it easier to narrow down which additive technology provides you with the right solution.



"Through our collaboration with Stratasys and the integration of their cutting-edge SAF and FDM technologies, we are setting new standards in the industry, ensuring every solution we offer is not only innovative but also sustainable."

Volker Stöcklin
RAUCH Managing Director

Questions to Guide Your Research

What are your goals?

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 initial objectives you might consider include how you want to use the technology across the following broad AM applications:

Prototyping

- Shortening the product development cycle
- Testing more design ideas in less time
- Illustrating ideas to colleagues or investors more clearly
- Producing functional prototypes to catch and correct errors earlier

Tooling and Production Aids

- Creating lighter, more ergonomic tooling using carbon fiber and other durable polymers in lieu of metal
- Customizing tools for the operator and task
- Producing tools faster to avoid lengthy lead times of conventionally made tooling
- Manufacturing dental and surgical guides customized for the patient

Production Parts

- Manufacturing mid to higher-volume or low-volume production parts
- Improving customization for products already in production
- Accelerating the production of full-color, patient-specific dental appliances

Education and Training

- Developing job-ready students for tomorrow's technical careers
- Creating lifelike patient-specific medical models for training and surgical preparation

In addition to considering the typical AM applications you might employ, answering the following questions will shed light on other facets of AM technology adoption you should examine.

What will you do with the parts you print?

- Will they simply communicate an aesthetic concept (form and fit)?
- Do they need to function like traditional production materials (form, fit, and function)?
- Will your printed parts be the final production components?

Are aesthetics more important to you than functionality?

- Do your models need to look realistic?
- Do you need parts that are clear or require multiple colors or varying textures?
- 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?

Where will your printed parts be used?

- Will they need to withstand heat or pressure?
- Will they be used outdoors and need UV resistance?
- Will they be exposed to water or chemicals?
- Do they need to hold tighter tolerances?

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?

What resources and skills do you have in-house?

- Depending on your technology choice, do you have staff that is available to learn and operate the technology?

What is your budget and timeline?

- How does your budget align with your AM goals and objectives?
- Could outsourcing be a best-fit option for short-timeline projects?

What level of workflow automation do you need?

- Do you need software integrations for seamless job scheduling and tracking?

How important is production data analysis and monitoring?

- Do you need real-time insights into material usage, machine performance, and part quality?

Your answers to these questions will go a long way toward helping you identify the best AM solution to meet your needs. More information in a subsequent section will help you with additional guidance that builds on the following information about Stratasys AM technologies.

Stratasys Technologies

Stratasys offers a broad range of additive manufacturing technologies. Each technology has particular advantages that address specific needs and cover a wide spectrum of use cases, allowing you to identify the right solution for your applications.

Use the following sections to better understand each Stratasys AM process, how the technology works, where it excels, and what materials are available.

FDM® (Fused Deposition Modeling) Technology

Developed by Stratasys over 30 years ago, FDM technology is by far the most accessible and widely used AM process. 3D printers that utilize FDM technology build parts layer by layer from the bottom up by heating and extruding thermoplastic filament.

Industrial-grade, production-level FDM systems (which should not be conflated with low-cost desktop alternatives) can process a range of thermoplastics with dedicated properties that include toughness, electrostatic dissipation, biocompatibility, UV resistance, high strength, and high-heat deflection. This makes FDM ideal for a variety of applications ranging from basic proof-of-concept models and functional prototypes to final production parts.

Learn more about FDM technology

Find out how Stratasys FDM® Nylon 12CF, a carbon-fiber material, replaced stainless-steel antennas with generative design, to make structures lighter and faster to produce.

Learn more

CONCEPT MODELS

FUNCTIONAL PROTOTYPES

MOLDS AND PATTERNS

JIGS AND FIXTURES

PRODUCTION PARTS

Compatible Materials

- Standard thermoplastics
- Engineering thermoplastics
- High-performance thermoplastics

Synonyms and Similar Technologies

- Filament extrusion
- Fused filament deposition
- Fused filament fabrication (FFF)
- Material deposition

Training Requirements

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

Facility Requirements

- An air-conditioned environment (temperature and humidity within an acceptable range)
- Compressed air is required for the F3300® and F900® printers

Ancillary Equipment

- Optional Fortus FDC™ filament delivery and drying cabinet (for F900 printers)
- Support removal system and optional finishing system

How Customers Use FDM Technology

Shape Corporation is a global tier-one automotive supplier and relies on FDM technology to increase production efficiency and keep pace with the competition.

Watch how AM helped Shape Corp. go faster and add more value.

Watch the Video ▶

"To keep Ducati at the forefront of engine design, we sought a technology that could make accurate, durable prototypes quickly. FDM was the only solution that could meet our requirements. The machines were as easy to install as a [2D] printer and they now constitute an integral part of our design and manufacturing process."

Piero Giusti
R&D CAD Manager, Ducati

PolyJet™ Technology

PolyJet technology is renowned for its outstanding realism and spectacular aesthetics. PolyJet 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 light.

Every PolyJet 3D printer offers sharp precision, smooth surfaces, and ultra-fine details. In addition, by combining a variety of photopolymers in specific concentrations and microstructures, the most sophisticated PolyJet systems can produce parts with materials that simulate everything from thermoplastics and rubber to human tissue, in a full spectrum 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.

Learn more about PolyJet multi-material and full-color capabilities ▶

CONCEPT MODELS

FULL-COLOR MODELS

MULTI-MATERIAL MODELS

MOLDS AND PATTERNS

DENTAL MODELS

ANATOMICAL MODELS

Compatible Materials

- Full-color photopolymers
- Clear photopolymers
- Flexible photopolymers
- High-impact photopolymers
- Photopolymers that mimic the look and texture of 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

How Customers Use PolyJet Technology

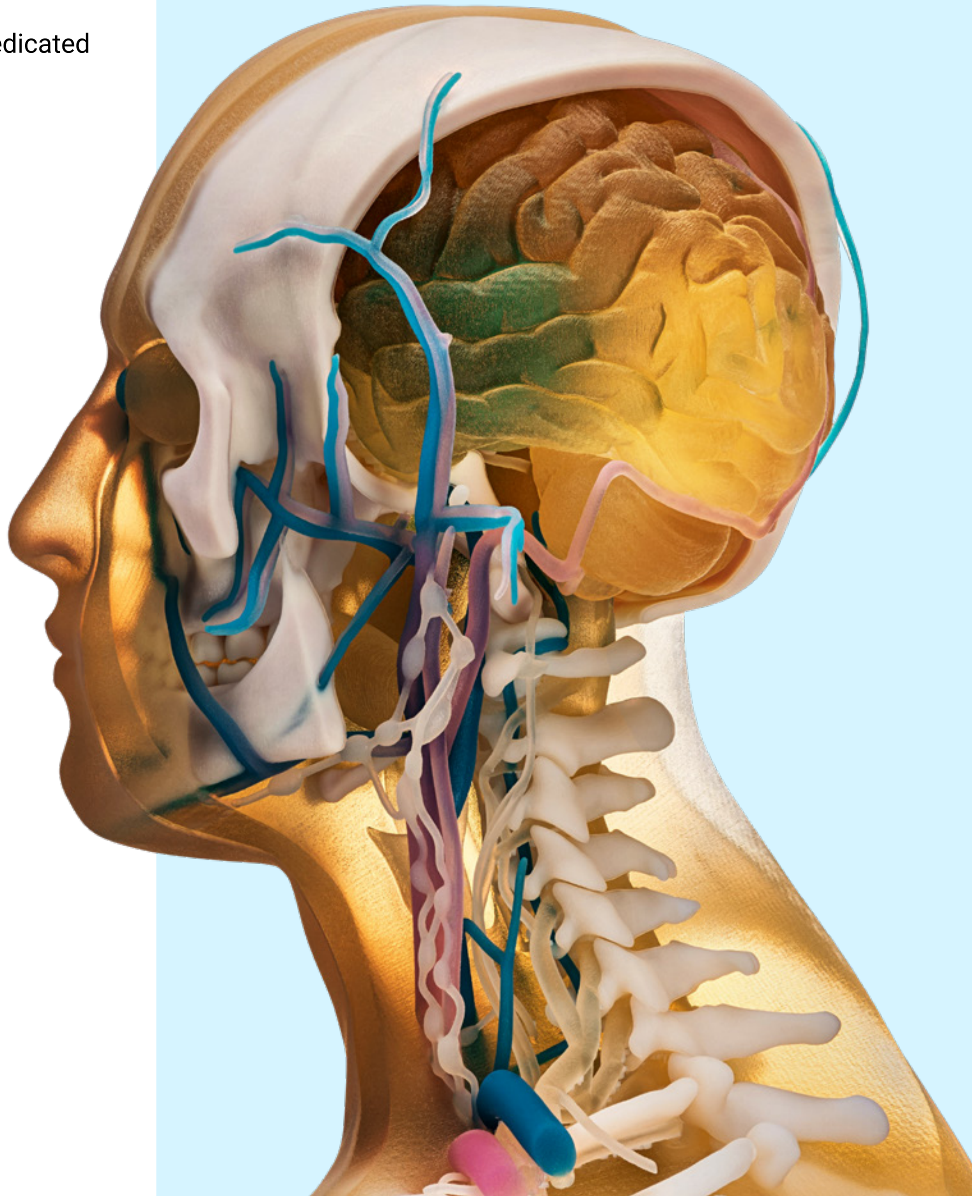
The first step to creating a product that stands above the rest in a crowded market starts with high-fidelity prototyping.

Discover how Priority Design, a product development company, amplified its design workflow.

Watch the Video ▶

“People say a picture is worth a thousand words, but a 3D print is worth a thousand pictures. The possibilities are endless.”

Michael Boelstoft Holte, Ph.D., M.Sc.
Head of Development and Director
3D Lab Denmark



Stereolithography (SLA) Technology

Stereolithography was the world's first 3D printing technology and it remains a great option for highly detailed prototypes that require tight tolerances and smooth surfaces. Product designers opt for Stratasys Neo® SLA models when a quick build time is crucial but they aren't willing to sacrifice resolution or accuracy. Neo 3D printers can also produce master patterns for urethane casting, and sacrificial investment casting patterns that are used to produce metal parts for aerospace, automotive, power generation, and medical applications.

Neo stereolithography is notable for producing large-format prototype parts that will ultimately be painted or coated because the models can be finished using the same materials and processes as the end product. Transparent and moisture-resistant materials can also be used when there's a need for flow visualization or light transmission.

Find out more about SLA Technology ▶

CONCEPT MODELS

FUNCTIONAL PROTOTYPES

MOLDS AND PATTERNS

DENTAL

Compatible Materials

- Photopolymers
- Compatible with 355 nm stereolithography resins (open resin system)

Synonyms and Similar Technologies

- SL
- Vat photopolymerization

Training Requirements

- Knowledge of build setup, moderate maintenance, machine operation and finishing, and proper material handling

Facility Requirements

- Temperature range: 20 – 23 °C (68 – 73 °F), maximum rate change ±1 °C/hour (1.8 °F/hour)
- Relative humidity: 20 – 50% noncondensing

Ancillary Equipment

- Neo®800 offload trolley
- Neo UV800 post-cure and heated resin store
- Neo Material Development Kit

How Customers Use Neo SLA Technology

Gulf Wind Technology develops rotor technology solutions and services for the wind turbine industry. The company takes advantage of the precision and size of the Neo SLA printer to rapidly accelerate its problem-solving capabilities.

See how Gulf Wind Technology used SLA to quickly develop highly accurate turbine rotor wind tunnel models.

Watch the Video ▶

“The superb smoothness of the parts from the Neo800 is a significant improvement over our previous machines. Our high standard of finish can now be achieved more rapidly. Coupled with the extremely large build volume, we were able to complete large 3D printed parts for BAC’s Mono R launch in even shorter timeframes.”

Ross Nicholls
Malcolm Nicholls Ltd

Selective Absorption Fusion® (SAF®) Technology

Selective Absorption Fusion (SAF) is a powder bed fusion 3D printing technology that delivers functional, production-grade parts with unmatched consistency. Ideal for high-volume, short-run production, SAF technology achieves accuracy and repeatability through advanced thermal management and precise fluid deposition across the powder bed.

Thanks to its unique inline unidirectional architecture, SAF technology prints, fuses, recoats (with Big Wave™ powder management), and heats powder in the same direction. The time-controlled manner of these processes and a uniform thermal experience across the entire print bed ensure consistent part properties. As a result, SAF technology delivers competitive cost-per-part outcomes together with production-level throughput, high part quality, and a high production yield.

A significant benefit of this technology is the SAF ReLife™ PA12 capability. This lets you reuse waste PA12 (nylon 12) powder from SAF technology and other powder-based additive systems, providing a much more sustainable and cost-effective process.

Find out more about SAF Technology ▶

PRODUCTION LEVEL

CONCEPT MODELS

JIGS AND FIXTURES

FUNCTIONAL PROTOTYPES

Compatible Materials

- Powdered thermoplastics

Synonyms and Similar Technologies

- 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 dedicated space for a large system
- An adequate extraction/ventilation system for powder handling
- Area for powder recycling and waste management

Ancillary Equipment

- Build removal box, powder retrieval station, trolley, and powder container
- Optional PowderEase™ T1 automated powder breakout, retrieval, and dosing system

How Customers Use SAF Technology

Roush Performance makes automotive aftermarket equipment. When a short-lead-time production problem occurred on its F-150 truck line, SAF technology became the go-to solution.

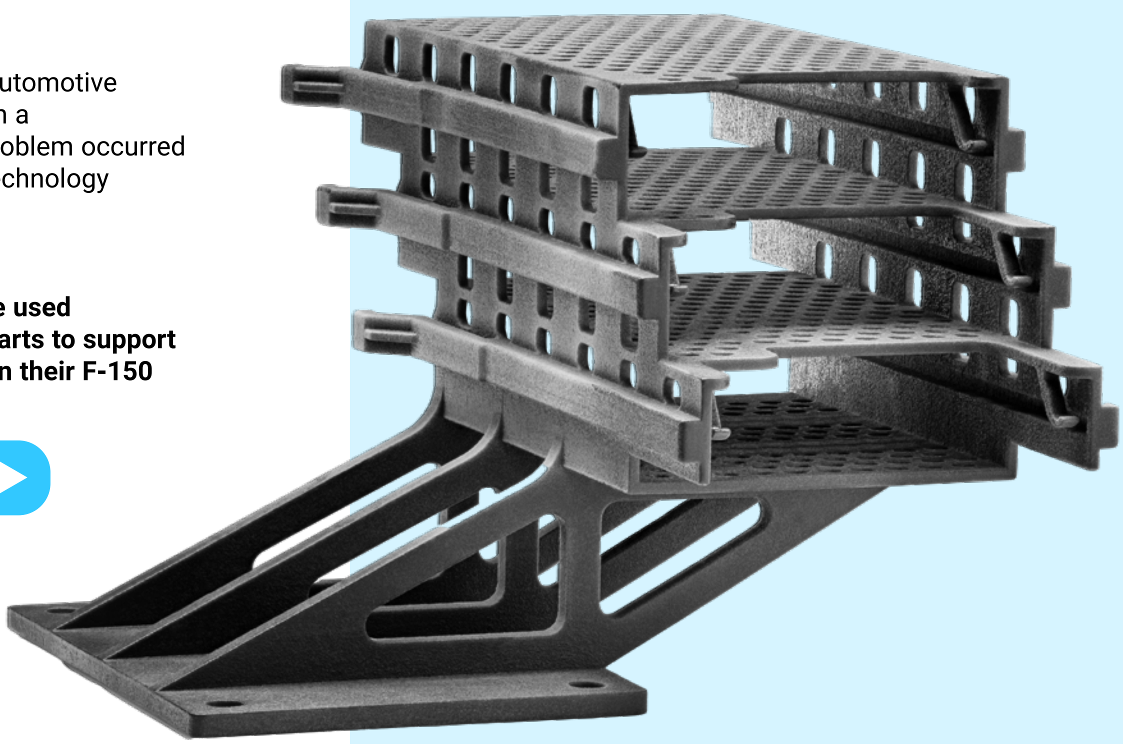
See how Roush Performance used SAF 3D printed production parts to support late-stage design changes on their F-150 pickup production line.

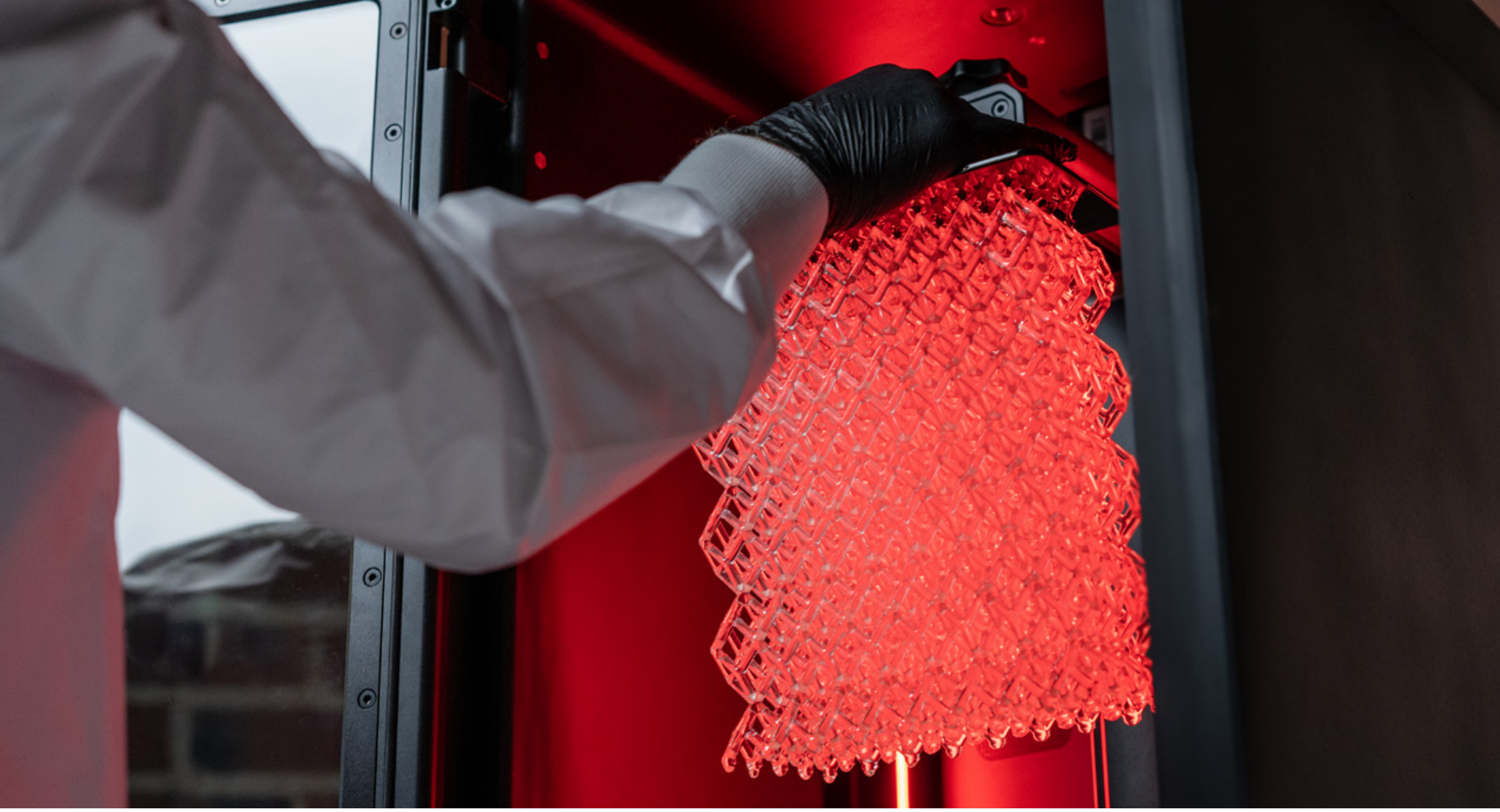
Watch the Video

“

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

Phillip Goetz
Owner of Goetz Maschinenbau





Programmable PhotoPolymerization (P3™) DLP Technology

Programmable PhotoPolymerization (P3) technology is an advanced form of DLP (digital light processing) additive manufacturing. P3 technology delivers parts made from high-performance materials with unprecedented accuracy and quality, ensuring the last part is identical to the first. P3 technology's fast print process helps produce parts more quickly and respond flexibly to shifts in demand that allows expanded production without delays — all while maintaining minimal inventory. This enables reduced part count, a simplified workflow, and improved product performance.

P3 technology delivers exceptional accuracy, consistency, and isotropy, allowing printed details down to 50 microns with high-accuracy. P3 technology delivers smooth, injection mold-like surface quality without secondary finishing, sanding, painting, or additional processing. It also offers additive manufacturing's design flexibility combined with a wide range of single-component, commercial-grade photopolymers to choose from.

Find out more about P3 Technology

MOLDS AND PATTERNS

JIGS AND FIXTURES

PRODUCTION LEVELS

FUNCTIONAL PROTOTYPES

DENTAL PARTS

Compatible Materials

- Choose from a wide range of production materials including:
  - Heat-resistent
  - Tough
  - General purpose
  - Elastomers
  - Medical-grade
  - Biocompatible

Synonyms and Similar Technologies

- Digital Light Processing (DLP)
- 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%
- Resin storage: typically 15 – 30 °C (59 – 86 °F)

Ancillary Equipment

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

How Customers Use P3 Technology

When the team at Spectra Group, maker of secure communications technology, saw that they could make parts that equaled injection-molded equivalents for a fraction of the cost, they were sold.

Watch how Spectra Group started with one use case and quickly expanded using P3 technology.

Watch the Video ▶

"The materials are very robust. People drop parts every now and then. These parts don't shatter."

Andrew Kosco
Engineering Manager
Thorlabs

Technology
Comparison

Each Stratasys 3D printing technology solves specific design, manufacturing, and production challenges. Use your answers to the questions at the beginning of this guide along with the following general guidelines to help narrow your technology options.

There are also several charts at the end of this section that provide a more visual representation of the differences among the Stratasys technologies. They include information about where each technology falls relative to key characteristics and applications.

- **If attaining highly aesthetic characteristics with minimal post-processing** is your highest priority, then PolyJet, Stereolithography, or P3 technologies should be top considerations.
- **If functional performance is a critical factor** for your applications, then FDM technology, which prints highly durable thermoplastics, is an excellent choice. It is also worth noting that SAF and P3 technologies can also print parts with extremely robust materials. However, the relative simplicity of FDM technology makes it an optimal selection in this scenario.
- **If you need longevity from your AM parts,** then FDM, SAF, or P3 will likely be the best fits for your application. The robust materials these technologies utilize print parts that can maintain their mechanical properties for years.
- **Depending on the specific AM technology you select, some orientation and training will likely be required.** Stratasys offers online training or in-person training through instructor-led courses, webinars, and e-learning modules for all its technology offerings.
- If you don't have the resources to manage a 3D printing lab or the expertise to operate or design for a certain technology, **outsourcing production is a good way to minimize risk and learn more about AM technology before dedicating resources to in-house capabilities.** A service provider such as Stratasys Direct® can provide a full range of AM services.
- **Some AM 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 providers.
- **Software capabilities are crucial to consider alongside hardware selection.** Advanced software solutions can dramatically improve workflow efficiency, part quality, and production scaling. Look for comprehensive software ecosystems that can support your current needs while providing room for growth. The ability to integrate with existing systems, automate workflows, and provide production insights can significantly impact your AM operation's success.

The following charts offer a quick overview of each technology's key points and qualities.

FDM Technology

Layer Resolution GOOD	●			
Thin Walls GOOD	●			
Surface Finish 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 EXCELLENT	●	●	●	
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 print), accurately mimicking biomechanical tissue properties

Weaknesses

Temperature sensitive, limited functional material properties, lack of long-term dimensional stability

Stereolithography

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

Strengths

Precision, surface smoothness, large build sizes

Weaknesses

UV-sensitive, extra post-curing steps, not as office-friendly as FDM and PolyJet, not optimal for functional prototyping

SAF Technology

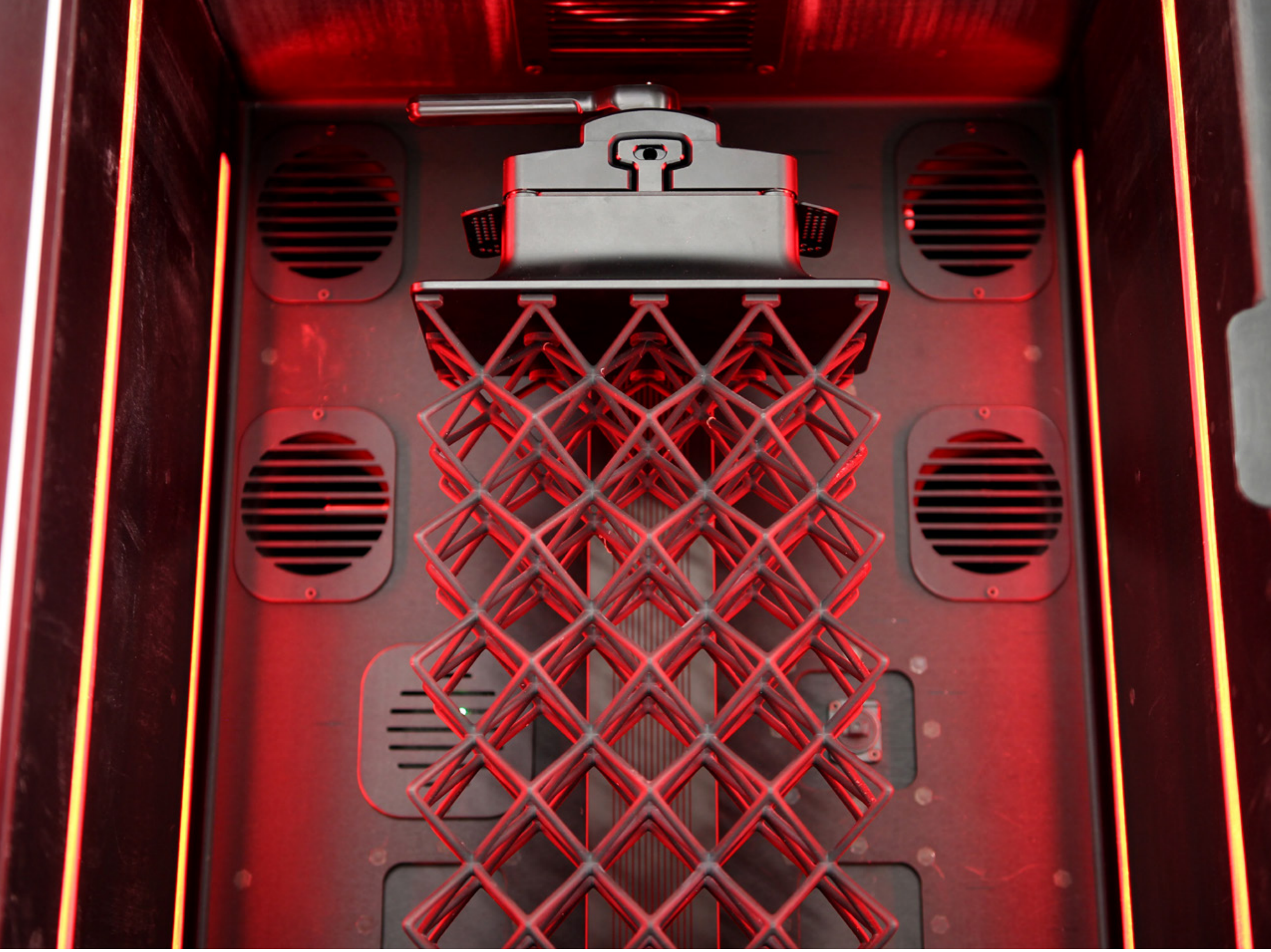
Layer Resolution VERY GOOD	● ●
Thin Walls VERY GOOD	● ●
Surface Finish VERY GOOD	● ●
Ease of Use GOOD	●
Product Development Application Versatility EXCELLENT	● ● ●

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, not office compatible



P3 Technology

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

Strengths

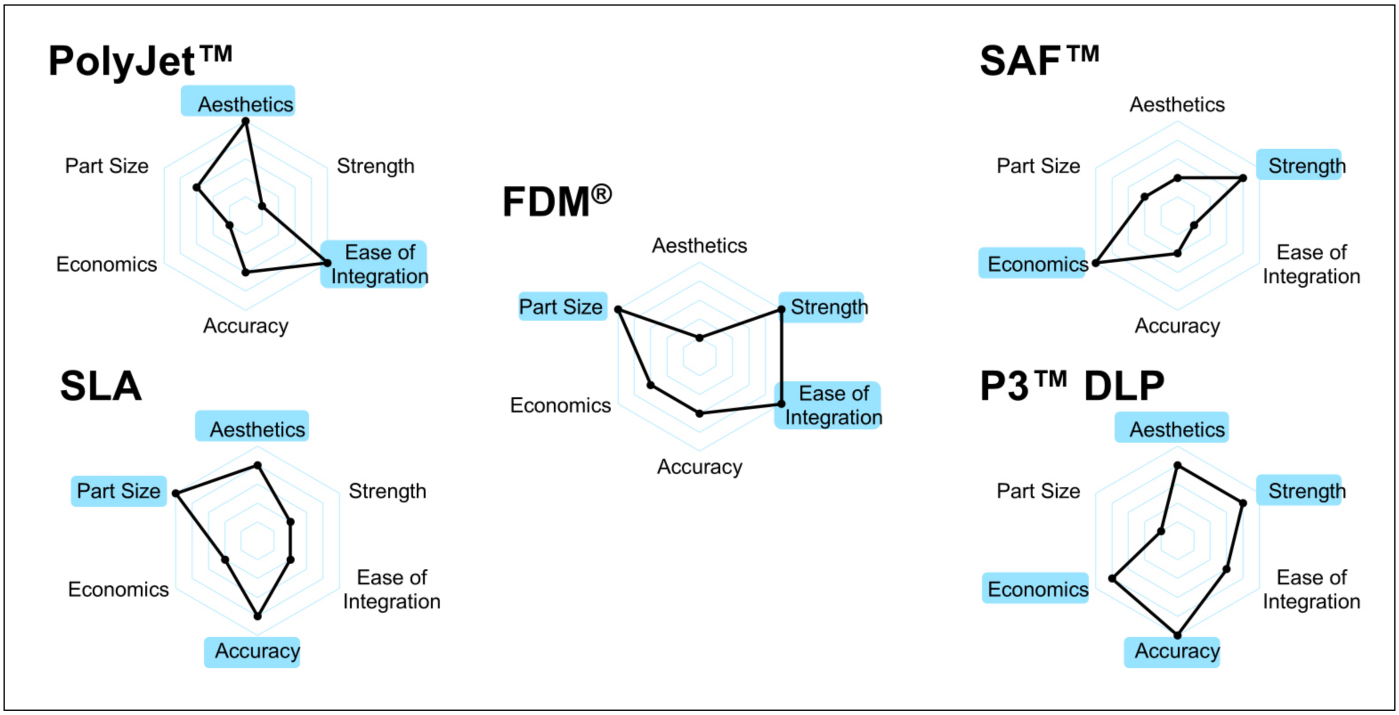
Rigid and flexible materials, surface finish, part strength, biocompatible materials, high throughput, lower cost per part, UV stability

Weaknesses

Extra post-curing steps, limited build envelope size

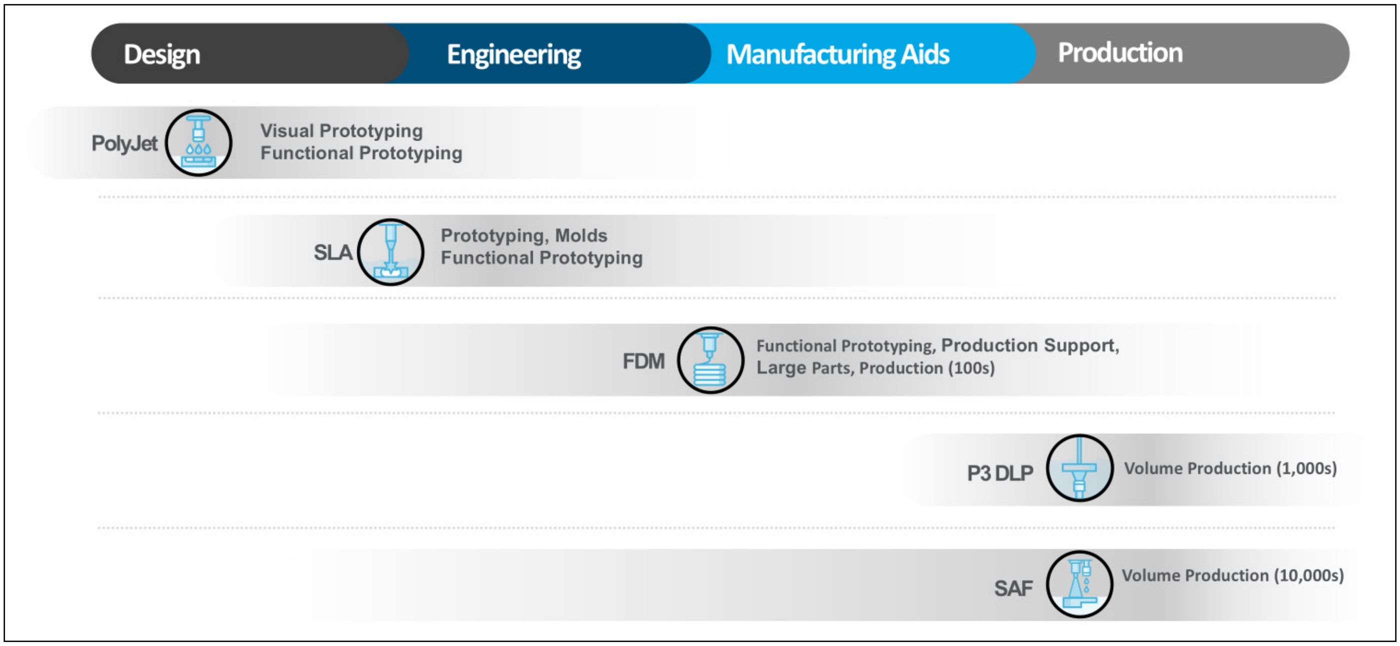
Key Attributes per Technology

The radar charts below highlight the relative strengths of key attributes across each additive technology. The farther a data point extends from the center, the more prominent that attribute is. For example, in the PolyJet chart, 'Aesthetics' appears near the outer edge—indicating it is a standout feature of the technology.



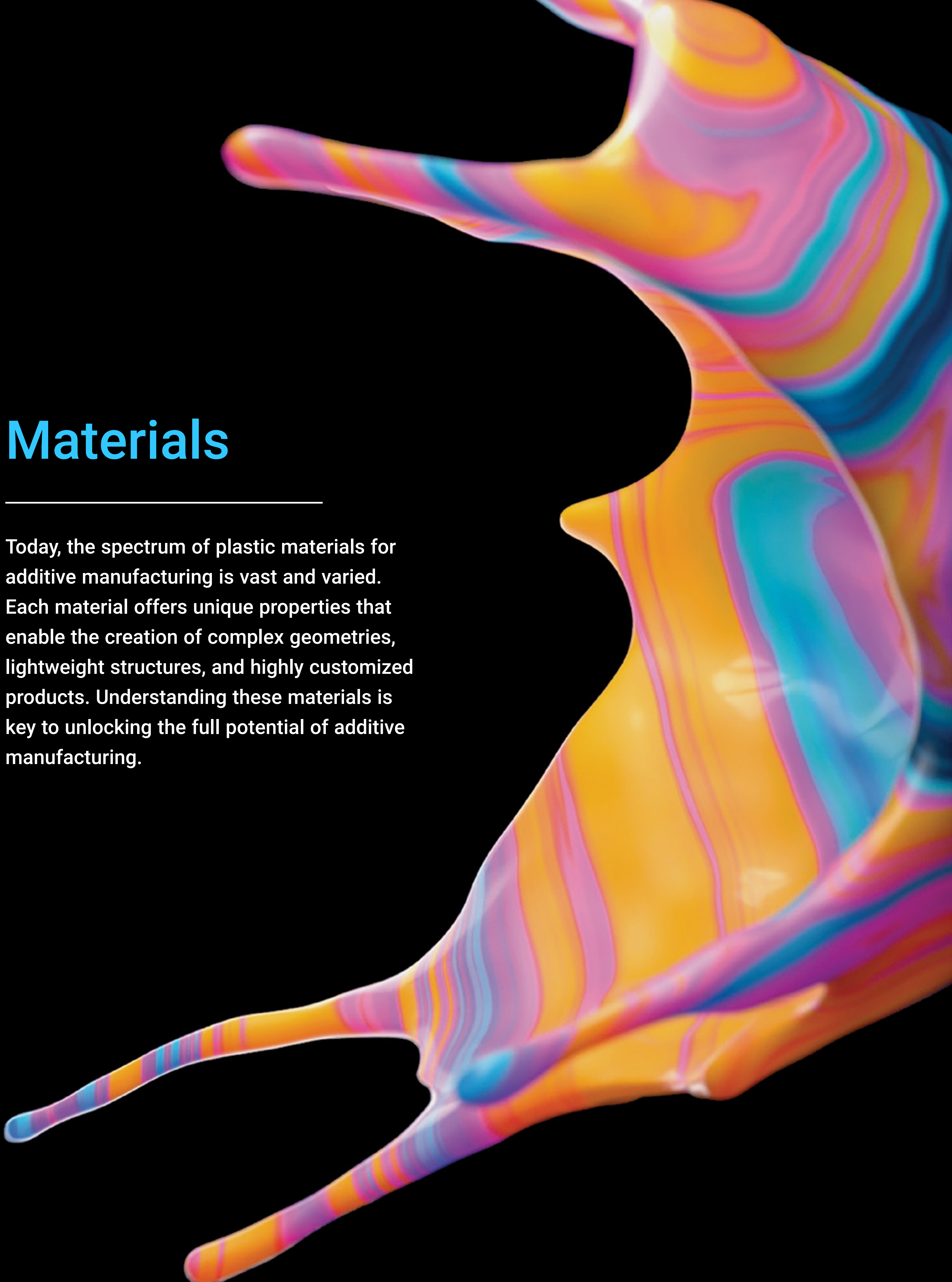
General Continuum of Applications by Technology

These four categories—Design, Engineering, Manufacturing Aids, and Production—represent common broad 3D printing application areas. The chart shows where each Stratasys additive manufacturing technology is considered a good fit.



Materials

Today, the spectrum of plastic materials for additive manufacturing is vast and varied. Each material offers unique properties that enable the creation of complex geometries, lightweight structures, and highly customized products. Understanding these materials is key to unlocking the full potential of additive manufacturing.



The Stratasys material ecosystem enables customers to meet demanding application requirements across all five technologies with accelerated access to top industry materials. The ecosystem includes three categories:

- Stratasys Preferred materials - engineered for optimal printer performance
- Stratasys Validated materials - tested for reliability to expand marketplace options
- Open materials - accessible via an OpenAM™ Software License

Stratasys also partners with leading AM industry material companies, further enhancing its diverse portfolio of materials to accommodate an ever-widening scope of AM applications.

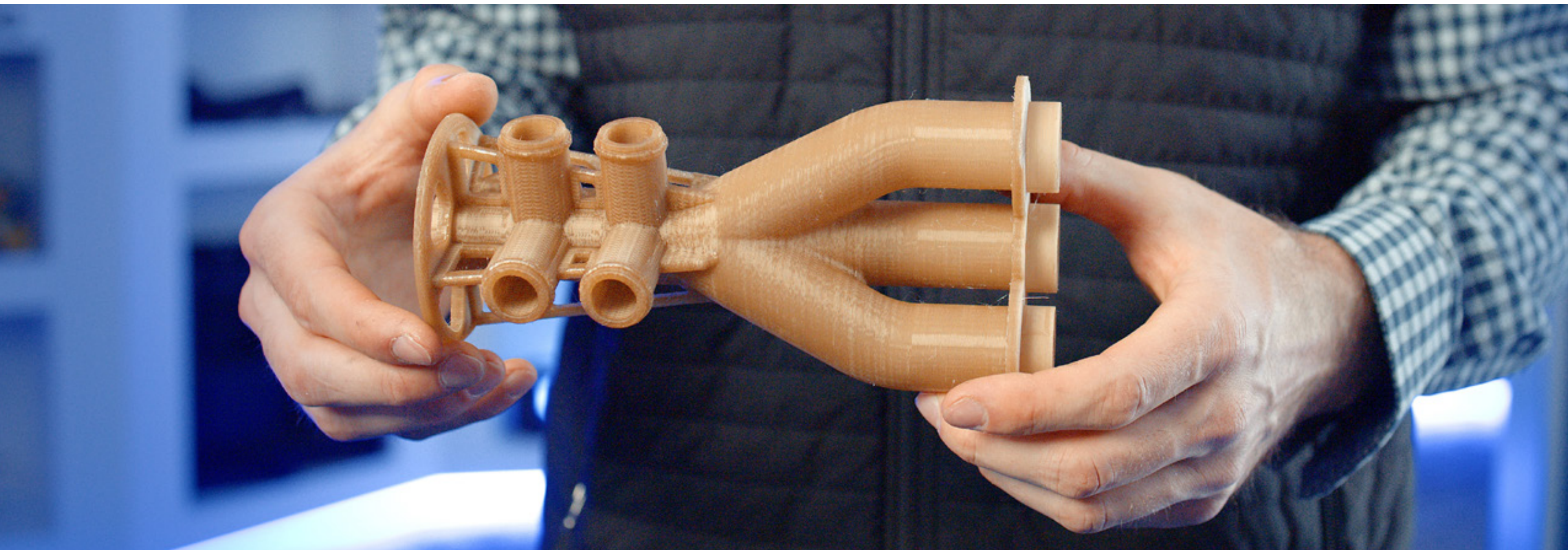
Material Forms

Materials are supplied in several forms depending on the specific AM technology they are used with. They are categorized according to their properties and performance.

Filament materials are the most common form used in FDM AM systems. The filament is melted and extruded onto a build platform to build parts layer by layer. Filament materials are highly accessible, generally more affordable, and are easy to handle. Filament spools and canisters should be stored to maintain dryness since moisture absorption can affect print results.

Resin materials are utilized with the PolyJet, Stereolithography, and P3 AM systems. These resin processes are generally categorized as "vat polymerization" and involve curing the liquid resin with a UV light source. Resin AM processes produce high-resolution parts with fine details and a smooth surface finish. Resin materials can be toxic and require careful handling. Some resins can degrade over time when exposed to sunlight.

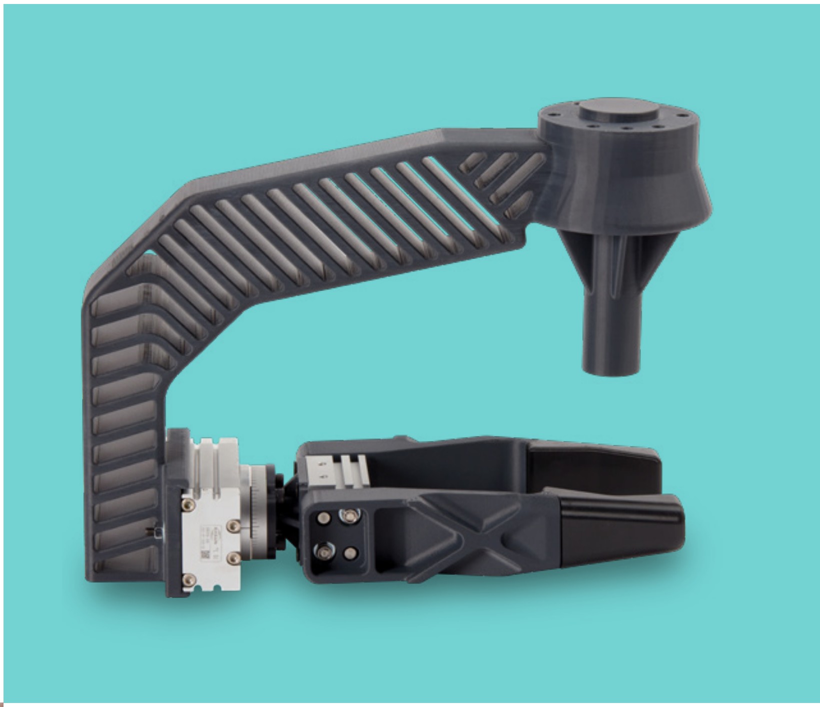
Powder materials are utilized with the SAF process. The powder is fused layer by layer using a combination of binder fluids and a heat source. Powder processes produce strong, functional parts with good thermal properties. Powder AM processes also support complex geometries, with minimal supports that would be impossible with other technologies (the unfused powder supports the part during printing). Powder processes typically require post-processing including powder removal and cleaning, and may require additional post-processing such as sandblasting or shot peening to achieve the desired surface finish.

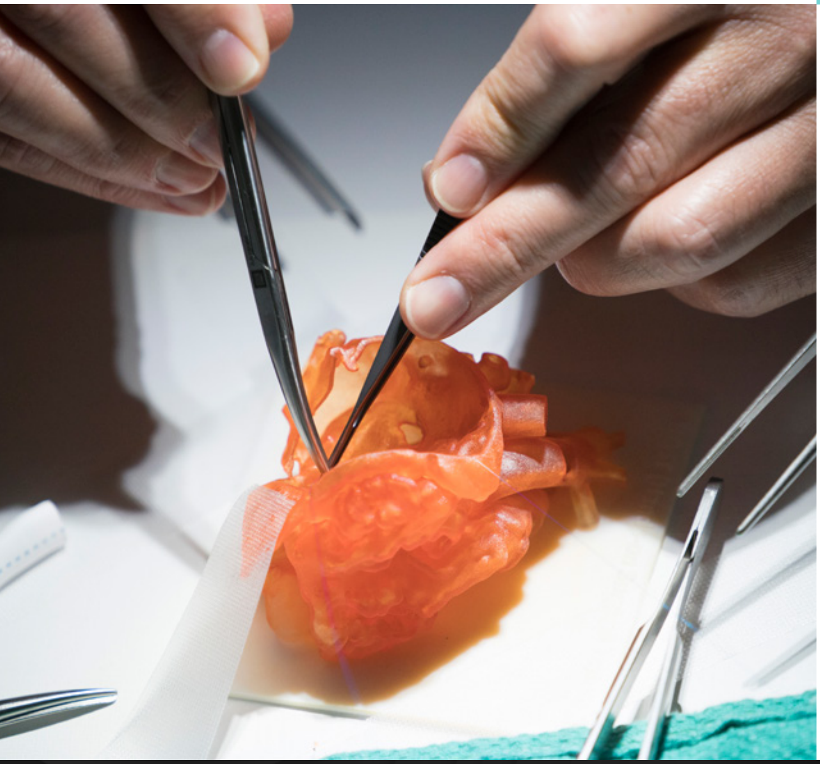


Material Types

Thermoplastics are the broadest category of AM materials and the most widely used. This category is vast and includes various general-purpose plastics found in mass-production processes like injection molding. It also includes engineering plastics for applications that require higher heat resistance, chemical resistance, impact strength, fire retardancy, or mechanical strength. Topping this category are high-performance polymers for production applications that have to meet stringent engineering requirements.

Applicable Technologies:
FDM (filament), SAF (powder)





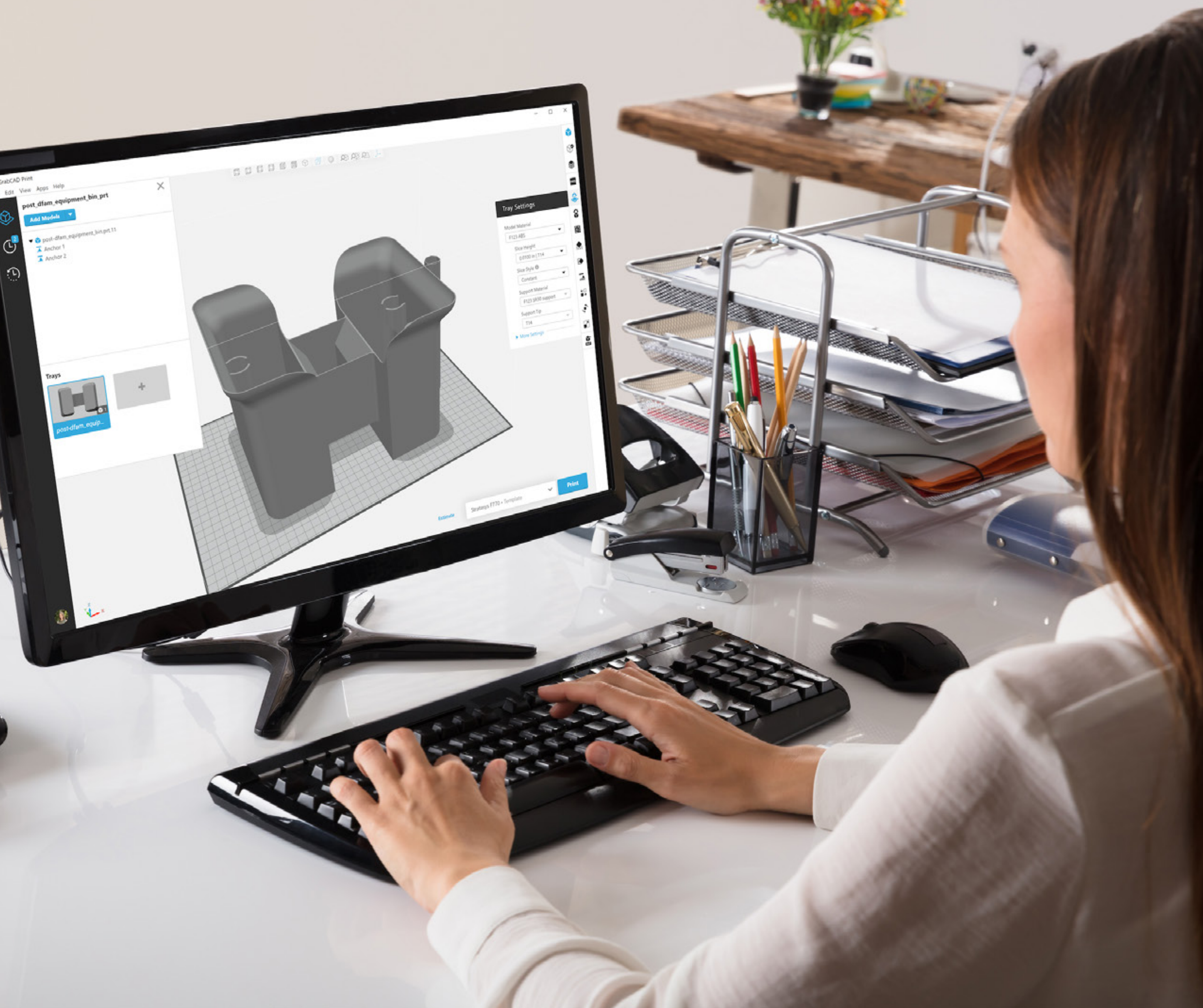
Photopolymers are a continually expanding category of liquid resin materials, largely due to their use with AM systems. Technical advancements are producing new formulations that focus on strength as well as fast cure times. Most photopolymer technologies print single, opaque colors such as grey, white and black, although many of them also have translucent or clear options. PolyJet is even more advanced and is capable of printing models with full and gradient color. Generally speaking, photopolymer technologies produce models with outstanding feature definition and an exceptionally smooth surface finish. However, by their very nature, photopolymers are UV-sensitive and this generally means that they are not as durable as production-grade thermoplastics.

Applicable Technologies:
PolyJet, Stereolithography, P3 DLP

Discover Stratasys materials portfolio

Stratasys Software Solutions

Stratasys offers a comprehensive software ecosystem powered by GrabCAD® and OpenAM applications that enables manufacturers to unlock the full potential of their additive manufacturing operations. Our integrated suite of solutions helps you seamlessly add new capabilities, run operations efficiently, and scale production with confidence.



GrabCAD Print™

Every Stratasys printer includes GrabCAD Print, a free, intuitive print preparation software that simplifies the 3D printing workflow. This continually updated software includes features such as automated material support generation, real-time print monitoring, and seamless CAD file compatibility. GrabCAD Print saves time by printing directly from CAD files, eliminating time-wasting manipulation of STL files. You can learn quickly on default settings or use more advanced features as needed.

GrabCAD Print Pro™

This premium software solution extends the capabilities of GrabCAD Print with advanced manufacturing control for production-grade results. GrabCAD Print Pro features Manufacturing Templates for consistent output and faster workflow, an Accuracy Center for superior part quality, and automated nesting optimization to maximize printer utilization. These capabilities let you reduce print preparation time, minimize waste, and achieve repeatable, production-quality results.

GrabCAD Streamline Pro™

As your additive manufacturing operations grow, GrabCAD Streamline Pro helps you maintain control and optimize production as you scale up. This comprehensive workgroup software suite connects people, parts, and printers while providing advanced analytics and monitoring capabilities to maximize printer utilization. Enhanced security features protect your intellectual property and ensure operational integrity.

OpenAM

OpenAM offers unprecedented control over the print process by allowing you to make deeper adjustments to your printer's standard print settings. With OpenAM you can develop custom materials, optimize material characteristics for specific applications, and achieve greater control over print results to enhance a printed part's characteristics.

GrabCAD Software Development Kit and Partner Program

The GrabCAD SDK lets you integrate Stratasys technology seamlessly into your existing software environment. Through our software partner program, you can access an ecosystem of leading software providers who have optimized their solutions for Stratasys technology, enabling end-to-end additive manufacturing workflows that drive innovation and productivity.

> "Using GrabCAD Print Pro gives us more control over the parts so we can control exactly what we end up with. The standards on these cars are extremely high. Every part can't just look pretty good, we need to make sure they're perfect."
>
> **Volker Stöcklin**
> RAUCH Managing Director

Experience GrabCAD Print Pro: 60 Days Free Access

Cost of
Ownership

From a cost perspective, the following six factors will influence your initial capital outlay as well as your ongoing costs to maintain 3D printing operations.

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 printing technology and printer choice.

Materials

Materials can be a large contributor to cost of ownership depending on the type and amount you'll consume. If you don't need high-performance thermoplastics or full-color multi-material capability, lower-cost material options may be preferable.

Equipment and Facilities

FDM and PolyJet printers can be installed in any office environment, while SLA and SAF printers have special facility requirements that add additional cost. P3 printers can be installed in an office but are best suited for an industrial setting.

Labor

All FDM and PolyJet printers are easy to use and don't require extensive training. SLA, SAF, and P3 printers may require more training and/or the need for personnel trained in this type of 3D printing technology. However, compared to traditional manufacturing technologies like machining, 3D printing typically requires less labor overall since no oversight is necessary during the printing process.

Support and Maintenance

An annual service contract can help minimize downtime, maintain production schedules, and keep costs stable and predictable. Consider the cost of these services against the cost of maintaining your AM systems with in-house expertise.

The Cost of Doing Nothing

Consider the cost of inaction — whether that means a slower design and decision process, too many change orders, a stagnated product line, or excess inventory with fewer turns. Operating within the status quo may appear to provide satisfactory results but there is an associated cost when compared to the efficiencies additive manufacturing offers.

Cost Comparison

The following table offers an overview of costs among Stratasys printers and is provided as general information. For more details about product costs, contact a Stratasys representative (stratasys.com/en/contact-us/).

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

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

*Excludes capital expenditure hardware investment costs

"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

Support and Services

The decision to invest in additive manufacturing for your business is a positive step forward. However, beyond identifying the best technological solution, further consideration must be given to deciding which additive solutions provider to work with.

Look for a company that can partner with you and has the ability to provide a full range of services and support as well as the experience to back that up. It is also important to choose a company that offers design, specifically design for additive manufacturing (DFAM) consulting, as well as an AM parts-on-demand service. If your in-house 3D printing capabilities are at capacity or your system is down for maintenance, access to a parts-on-demand service could be the difference between hitting or missing your deadlines.

Stratasys offers a comprehensive suite of additive manufacturing products and services to help you with any challenge you may encounter. This is backed by experience and expertise in every area.

Stratasys Direct

For any company looking to engage with additive manufacturing for the first time, investing in a new system can be a pretty daunting undertaking. If any doubts exist, outsourcing your AM requirements can provide a low-cost entry with minimal risks as it requires no upfront capital investment. Stratasys Direct is one option and has the experience and expertise with all Stratasys technologies mentioned in this guide. Engaging with a service like this can provide access to industrial-scale AM technologies and makes it easy to "try before you buy."

If you're not sure which technology and material combinations will work best for your application, you can leverage Stratasys Direct's extensive expertise to help you identify the optimal solution. Using Stratasys Direct in this way is a great way to characterize different solutions and learn more about how your operations can benefit from AM technology.

To receive an instant quote and to have Stratasys Direct print your parts, simply upload your CAD file to our intuitive website. We'll print and deliver your parts quickly using your technology and material selections.

Learn more or request a quote at:

stratasysdirect.com

Endless Possibilities for any Industry

Compressing Product Development Time

The original application of AM — rapid prototyping — is not going away any time soon. In fact, today's AM technology makes prototyping faster and more precise, with greater functional performance. This is a staple baseline of the capabilities of additive technologies that will only continue to grow and expand.

High-Performing Factories Across All Sectors

Today, additive manufacturing is supporting companies of all sizes to streamline the entire manufacturing process and improve the performance of factories around the world. AM is making a significant impact – from product development to customized tooling, jigs, and fixtures that increase production speed, quality, and employee safety, to full production of end use parts at higher volumes.

Personalized Healthcare

The healthcare sector is arguably one of the fastest growing beneficiaries of additive manufacturing. AM is transforming both primary care as well as clinical and training environments. For surgeons, AM can produce customized surgical guides and patient-specific medical models to improve surgical outcomes. This also enables surgeons to help practice procedures, train doctors, and visually explain the procedure to patients and their families. Meanwhile, medical device companies use 3D printing to prototype and manufacture new, life-saving products and train doctors on new procedures. Finally, AM can be used for high volume production and mass customization of hearing aids, dental aligners, orthotics and dentures.

Modernizing Supply Chains

Additive manufacturing is traditionally associated with low-volume production. This is because of its history as a prototyping solution and its gradual evolution into a manufacturing solution over three decades. However, today some AM processes are a competitive and viable option for production volumes up to 10,000+ parts. Although AM cannot compete with injection molding at very high volumes, there is a growing overlap where either AM or injection molding could be the best fit for your application, depending on part size, design variations, and production batch size. A key advantage of AM in this scenario is its design freedom, combined with the ability to reduce inventory costs with on-demand production while also eliminating the high expense of injection mold tooling.

Expert Help is Always Available

Our network of authorized resellers is extremely knowledgeable and responsive. We are ready to help you find the ideal 3D printing solution for your organization based on your applications, budget, and timeline.

Contact us today to learn more about how additive manufacturing can positively impact your business (stratasys.com/en/contact-us/).

To find a reseller, visit
stratasys.com/contact-us/find-a-local-reseller

Or, simply give us a call at
1-800-801-6491

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