ebook

Rapid Prototyping: Increasing Agility in Design and Manufacturing

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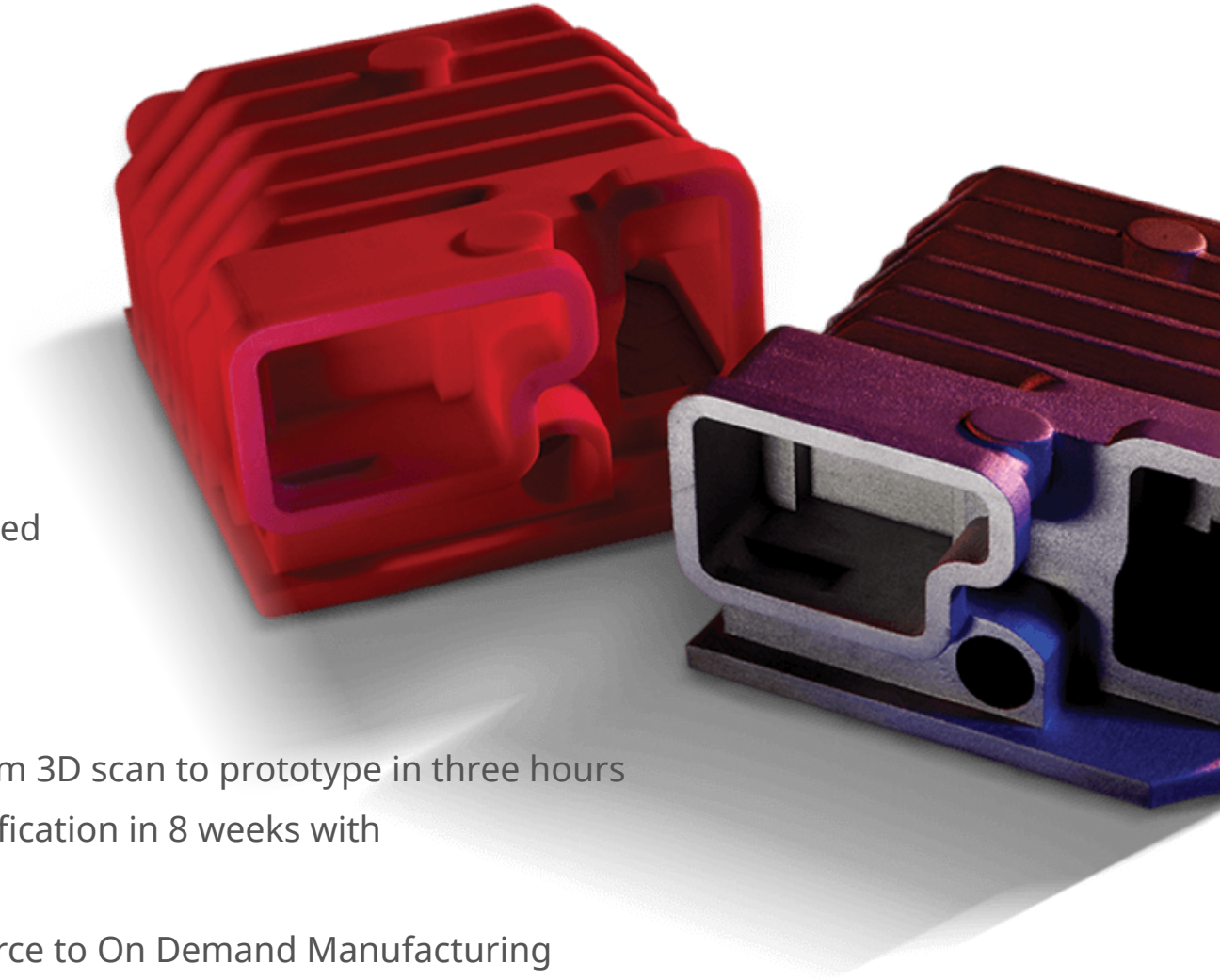

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Introduction

Today's product development landscape is characterized by high demand for variety, increasing customer expectations, and near constant innovation.

To top it all off, product lifetimes are shrinking. The result is driving greater competition among manufacturers with the pressure to do more, better, and faster.

No Olympian has ever taken home a gold medal without intensive training. In the same respect, no winning product design has ever been the result of beginner's luck. Product development is training for game day and requires cycle after cycle of effort, feedback, and improvement.

To stay competitive in a market that is perpetually shrinking time to market, manufacturers need to meet and break new release schedules in their product development cycles. Rapid prototyping offers that opportunity.

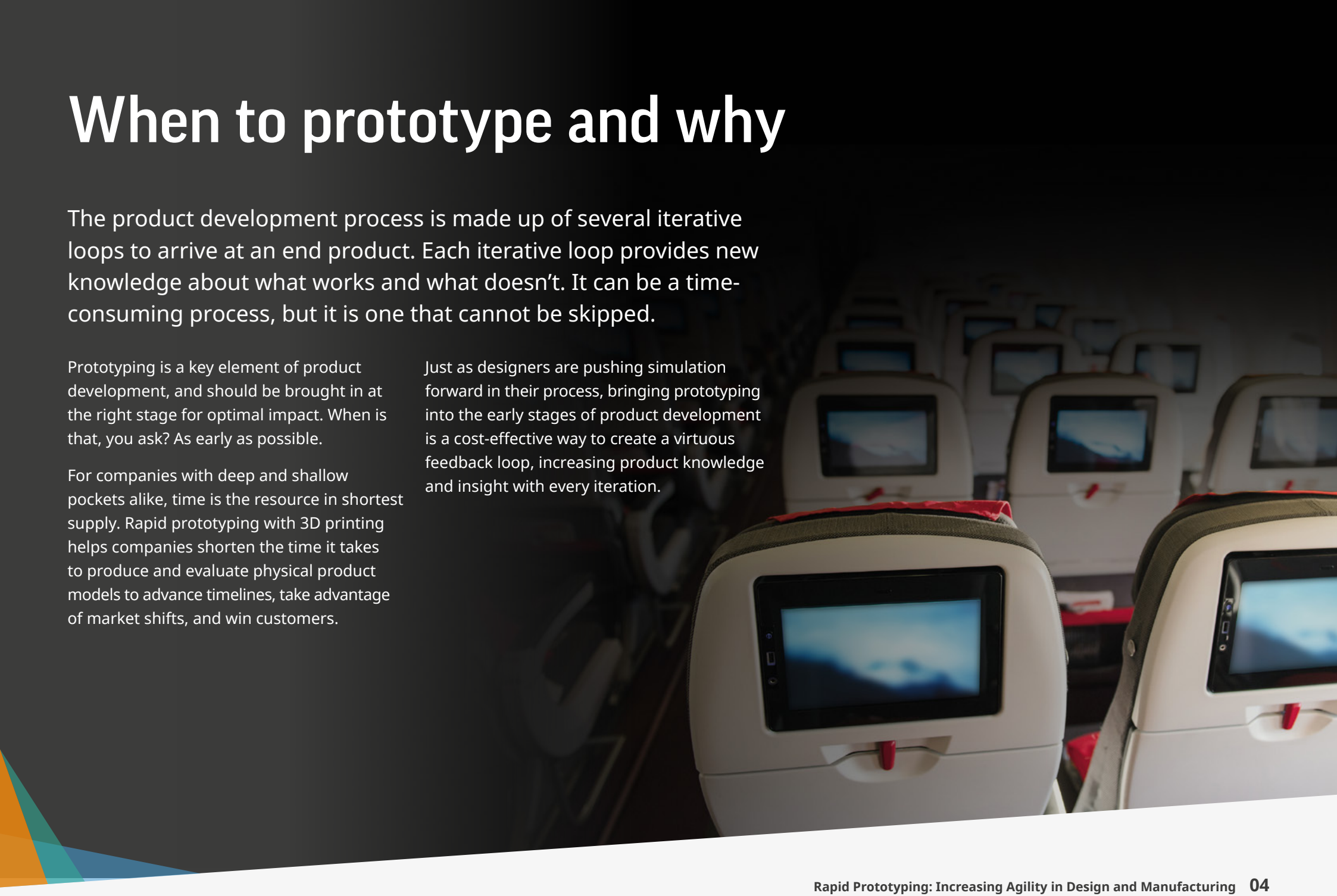
When to prototype and why

The product development process is made up of several iterative loops to arrive at an end product. Each iterative loop provides new knowledge about what works and what doesn't. It can be a time-consuming process, but it is one that cannot be skipped.

Prototyping is a key element of product development, and should be brought in at the right stage for optimal impact. When is that, you ask? As early as possible.

For companies with deep and shallow pockets alike, time is the resource in shortest supply. Rapid prototyping with 3D printing helps companies shorten the time it takes to produce and evaluate physical product models to advance timelines, take advantage of market shifts, and win customers.

Just as designers are pushing simulation forward in their process, bringing prototyping into the early stages of product development is a cost-effective way to create a virtuous feedback loop, increasing product knowledge and insight with every iteration.



Faster time to market

When prototyping can happen in hours instead of days, it benefits final product function as well as economics.

Companies that want to measure success in reducing and improving their product development process should examine two key factors:

Lead times:
total elapsed time from concept development to initial production.

Engineering effort:
the total man-hours required to go from concept development to initial production.

Taking these factors into consideration, transforming a design into a physical object has never been more efficient or affordable than with rapid prototyping solutions.

3D printing for rapid prototyping can dramatically improve development cycles by reducing lead times and engineering effort.

Prototyping for agile manufacturing

Creating physical prototypes with 3D printing is part of an iterative, agile design and manufacturing process that promotes four strategic benefits by:

Facilitating design modularity:
Breaking products down into logical modules for rapid prototyping can help companies speed up their design process and advance product outcomes. Each design module opens new opportunities and options to explore in parallel.

Accelerating knowledge generation:
Each prototype provides new information that is hard to gain in other ways. This information can be quickly and intuitively shared among all team members.

Advancing communication with process partners:
Product development is often a collaborative process. Sending 3D files back and forth to be prototyped is a fast way to explain design changes and stay on the same page.

Fostering a culture of knowledge:
Incorporating prototyping as part of an agile, iterative product development process instills and reinforces the quest for better product knowledge.

Questions to ask before getting started

Although prototypes are relevant throughout product development, the purpose they serve evolves as product development approaches product launch.

For some products, advanced evaluation stages require new approaches to prototyping, whereas other products allow for greater consistency in prototyping methods.

A few questions to ask when selecting a prototyping technology include:

- **What is the purpose of the prototype?**
- **How long does the prototype need to last?**
- **Is material important?**

Answering these simple questions will help narrow your focus to find the right solution for your needs.

Types of prototypes

There are essentially two main types of prototypes: those that need to look like the end product, and those that need to perform like the end product.

Of course, there are plenty of gradients in between, but this simplified view can help you identify where your needs fall on the appearance-function spectrum.

Appearance Models

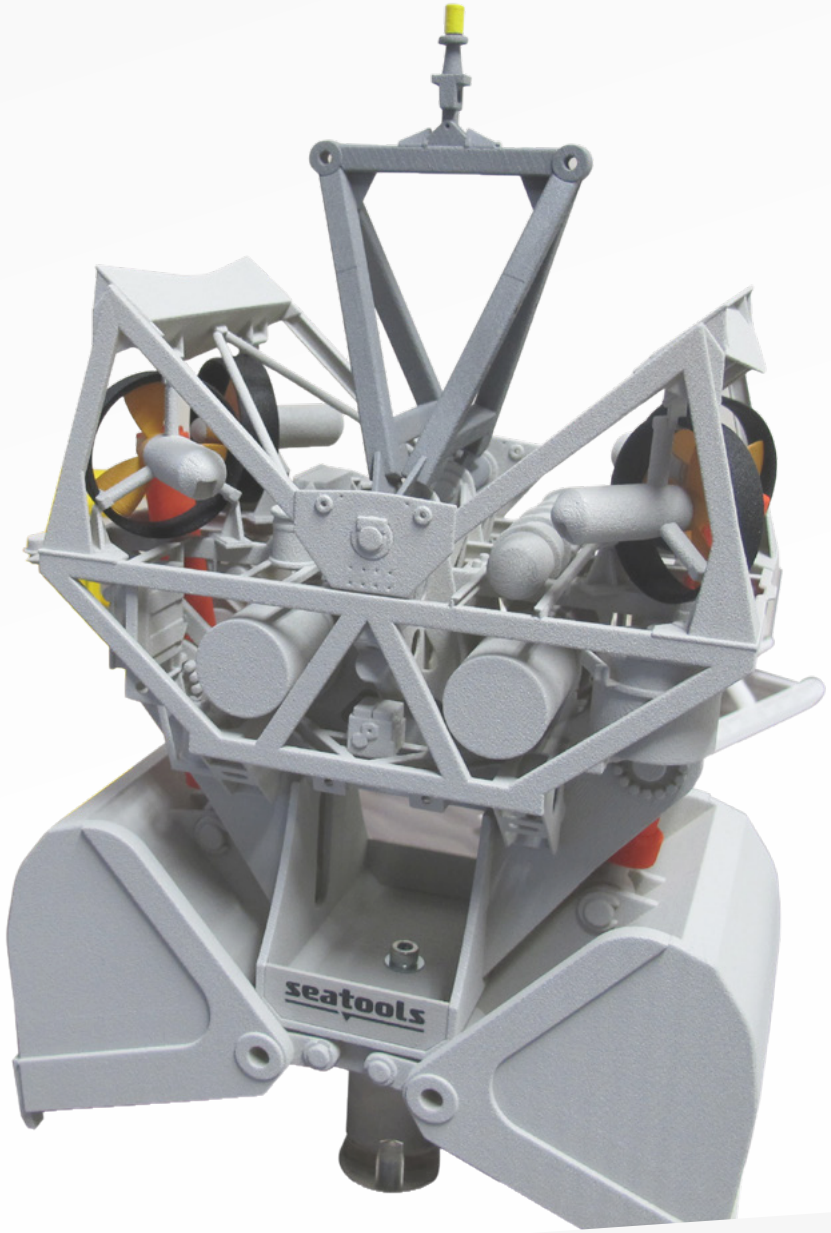
As the name suggests, an appearance model is a high-level visualization of a product or design idea.

The uses and purposes of appearance models can vary greatly throughout product development and can add value at any stage.

Early prototype appearance models offer an opportunity to evaluate and evolve designs, whereas compelling functional appearance models at later stages can be used to solicit consumer feedback or help secure investors or buyers.

In large equipment manufacturing and construction, scaled appearance models play a vital communications role to ensure upfront alignment among stakeholders, inspire discussion, and bring dimension to concept drawings.

For advanced appearance models that may require meticulous painting, assembly or a hybrid manufacturing approach including CNC milling, vacuum casting, color developing, mechatronics or engineering services, global On Demand Manufacturing services are available to supplement capabilities and offset demands on in-house resources.



Functional prototypes

Once a system has been defined theoretically, it must be made practical.

Functional models can confirm the form, fit, articulation, and interaction of components to ensure product designs are on track or enable fine-tuning for the desired results.

The same holds true for prototyping for investment casting patterns. SLA 3D printing delivers ultra high precision parts and superior surface finishes in about 10% of the time it takes to make a traditional casting pattern. This means engineers have the flexibility to print and test multiple gating configurations to ensure the very best investment casts can be made.

With a high precision 3D printing process, the parts produced will reflect the CAD data provided, resulting in high-quality prototypes for thorough fit and function testing.

High accuracy and superior surface finishes, delivered in about 10% of the time it takes to make a traditional pattern.

CASE STUDY

Emory Motorsports. From 3D scan to prototype in three hours

Emory Motorsports specializes in building and restoring vintage Porsches and promises its customers to only introduce better-than-factory updates tailored to the specific requirements of the job.

In the process of conducting a complete body renovation, the crew needed to develop a new windshield strut for a classic Porsche. To get the owner's sign-off, a prototype needed to be produced to ensure satisfaction and agreement with the concept.

Challenge
Reverse engineer, redesign and test an accurate windshield strut.

Solution
3D scanning and 3D modeling with Geomagic Design X followed by SLA 3D printing through On Demand Manufacturing.

Results

- **3D scan to solid CAD model in three hours**
- **5-day turnaround from online order to part in hand**
- **Immediate on-vehicle testing of strut prototype**

Read the full story

CAD data to full-sized vehicle for verification in 8 weeks with On Demand Manufacturing

On Demand Manufacturing engineers can help players in the automotive industry reach development milestones faster by rapidly delivering prototype vehicles for design verification.

Using a high proportion of SLS and SLA 3D printing alongside parts produced with laminated resins, carbon fibers and urethane casting, a final car prototype can be completed eight weeks from accepting the CAD data. The customer can then gather its design, production, and maintenance teams to conduct comprehensive full-vehicle assembly, interference and other tests.

Vehicle testing options include:

- **Complete assembly cycles**
- **Component assembly**
- **Ergonomic validation from the customer side**
- **Interferences and optimizations for process improvements**
- **Accessibility for maintenance**

Prototyping in-house versus out-source to On Demand Manufacturing

Let's say you're convinced rapid prototyping is a crucial element missing from your process and you're ready to bring more agility to your product development workflow. How do you determine if you should bring 3D printing in-house versus contracting your rapid prototyping to a service bureau?

The benefits of using an On Demand Manufacturing service include the ability to offload labor while gaining access to a broad scope of materials options, possible model sizes, and expert finishing techniques. When ready, an on demand service provider can also help users transition into full manufacturing as a bridge to production.

Ask an expert about on demand manufacturing

With that being said, these benefits do not resonate with every user. If you anticipate needing roughly the same size and material of model just in different design iterations, it may be more cost effective to research your options and bring rapid prototyping in-house. Of course, that research can always include ordering trial models on demand to verify the fit of a specific technology within your workflow.

Learn about bringing 3d printing in-house

Rapid prototyping material options

Rapid prototyping materials are typically plastics and can mimic a wide array of engineering materials.

For example, rapid prototyping can mimic elastomers and composites in terms of flexibility, durability, stiffness, toughness, stability, transparency/clarity, look and feel, bio compatibility, temperature or water resistance, and more.

Other materials supported by 3D printing can also be used, such as polymers, metal, and ceramic.

Which 3D printing technology is right for my application?

3D-printed prototypes can be created directly from CAD in hours compared to the weeks this process can take using traditional model-making, CNC machining, or tool-based production. There are a number of 3D printing technologies to choose from. The main ones are detailed below.

Stereolithography (SLA)
3D printers are particularly well-suited for prototyping and offer high resolution printing, crisp part details, suitability for painting, plating and finishing, and a range of high-quality materials for a variety of uses.

Selective Laser Sintering (SLS)
3D printers and robust nylon materials apply well to prototypes of crash test parts, including child car seat designs, sports helmets, and other applications where impact resilience matters.

MultiJet (MJP)
3D printers deliver very fast, high resolution parts that are ideal for multi-material product designs including overmolding and living hinges, snap-fit testing, etc.

ColorJet (CJP)
3D printers enable the rapid and inexpensive production of prototypes in vibrant full color, well-suited to prototyping for shoes, pottery designs, and other prototypes that need color output for review.

Achieving prototypes in hours, rather than days or weeks, enables companies to accelerate time to market and deliver superior products in shorter timespans. With 3D-printed prototypes, designers can have new iterations of a design prototyped daily, enabling the evaluation of 12–15 new iterations in the same time it takes one prototype to be produced using traditional processes.

An increased frequency of iterations means designers have the time and opportunity to improve designs while still delivering within or before deadline.

3D printing prototypes allows compression of the product design cycle with the potential for far superior products at completion.

Full manufacturing lifecycle and production support services

3D SYSTEMS
On Demand Manufacturing

Rapid prototyping

- For fast design iterations and part testing
- Quick turnaround times
- Consistently high quality

Advanced Prototyping

- Simplify your product development process
- Additive and traditional manufacturing processes
- Lower costs and reduced design risks

Appearance Models

- Transform your design into reality
- Comprehensive range of materials and processes
- Trusted by manufacturers across the world

Low-Volume Production

- Reduce tooling costs
- Iterate designs
- Diverse range of technologies available

What's next?

Interested in learning more about rapid prototyping and 3D printing?

Our experts are here to support you.
Get in touch today - we will be right with you.

Get in Touch

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