LUMITEX™

Rapid Prototyping

Increasing Proficiency in Design

Rapid prototyping is the group of techniques/technologies available to engineers to create a three-dimensional scale model of a physical part or assemble them using 3D CAD data.

RP is greatly broadening the manufacturing industry with its easy transformation of assembling a physical object from a digital model to test for *form, fit and function.* In its simplest terms, it is the **process of creating prototypes to evaluate an engineering product design**.

As illumination experts, we are dedicated to stay on top of the competitive landscape manufacturers are faced with today. In a world that is constantly seeking faster time to market, manufacturers need to expedite their time-frame and schedules in the product development cycle. Rapid prototyping offers companies the opportunity to remain competitive with *introducing new products faster.*

In this article, we discuss the benefits of rapid prototyping, compare technologies, and review different prototyping stages and factors that should be considered.

Prototypes: Indispensable Part of Engineering Product Design

Prototypes are vital especially when it comes to the *new product development process.* They help eliminate risk and bring a product idea to life. There are many terms tossed around the industry when we think of prototyping.

The terms "prototyping", "rapid prototyping", "3D printing", and/or "additive manufacturing" are commonly used side-by-side. They are used interchangeably, but in fact have different meanings.

Difference Between 3D Printing and Rapid Prototyping

"Rapid prototyping is the technique of fabricating a prototype model from a CAD file. **3D printing/additive manufacturing is the process**, and **rapid prototyping is the end result**. Rapid prototyping is one of many applications under the 3D printing/additive manufacturing umbrella." [Source]

Rapid Prototyping is an application used in additive manufacturing to create a model *faster* than what would be considered the normal process. Engineering Product Design states,

> "3D printing on its own or in combination with other processes could be used to create rapid prototyping."

Let's look at the difference between traditional prototyping and rapid prototyping. Both are **advanced processing methods for prototypes.**

However...

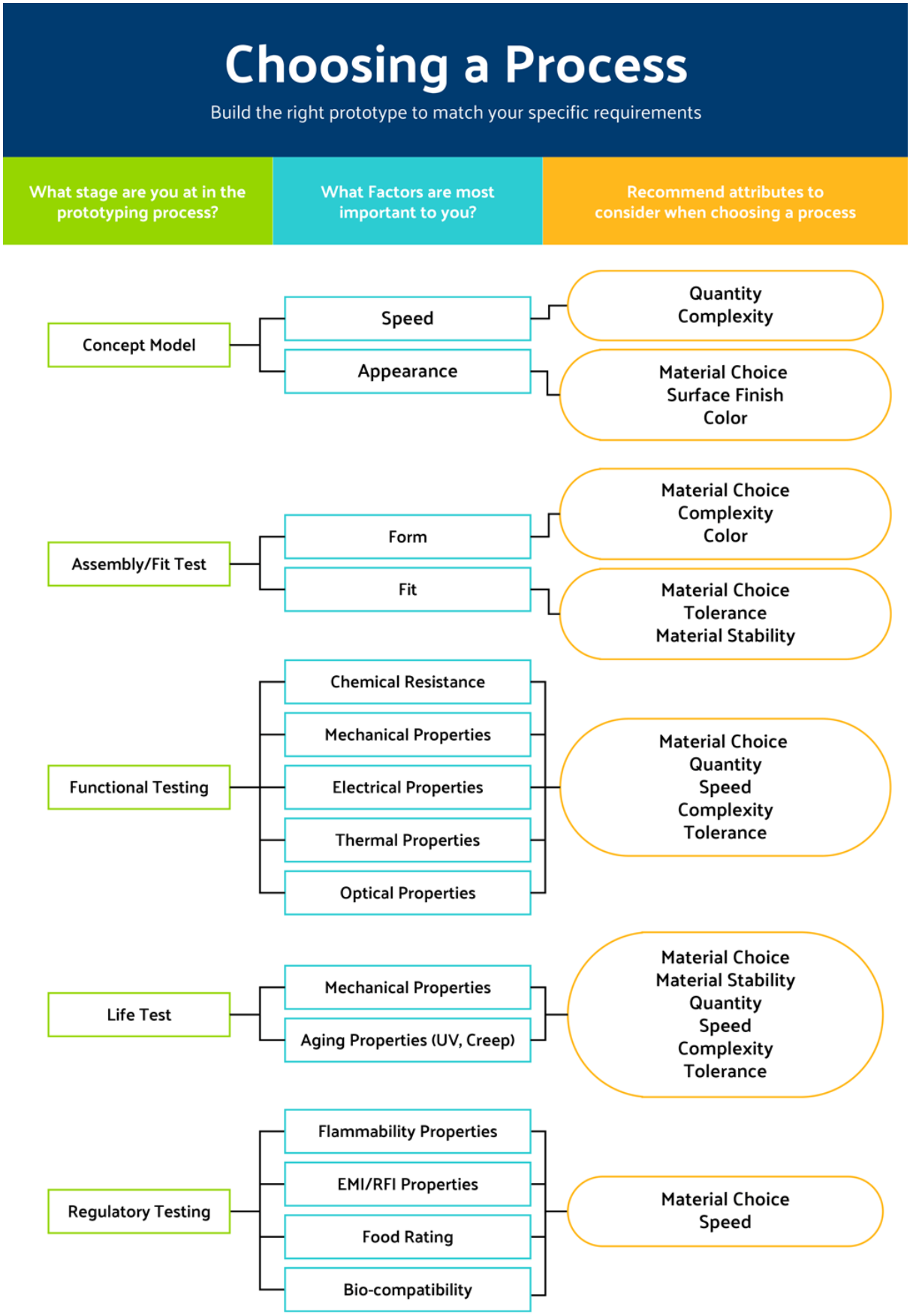
They use a completely different process.

Difference Between Rapid and Traditional Prototyping

Rapid	Traditional / Conventional
Process is considered "additive". Parts are built up by adding in a horizontal layer process.	Process is considered "subtractive". Parts are built by removing material from a block of unwanted material.
Controlled mostly by machines and software - less human interaction	More human interaction and human expertise
Models are created faster. Reduce the time between iterations.	Takes more time
Cleaner in the process - less dust and waste	Less "clean" in the process
Difficult shapes can be built	Useful for easy, and simple shapes

Selecting a Rapid Prototyping Process

In order to build the right prototype to match your specific requirements, you need to decide which factors are the most critical based on your situation.



source: https://www.protolabs.com/resources/white-papers/rapid-prototyping-processes/

Methods/Technology Available for Different Applications

Stereolithography (SLA) - technology that converts liquid materials, layer by layer, into solid parts by curing them using a light source process.

Laser Sintering - additive manufacturing (AM) technology that utilizes lasers to sinter powdered plastic material (typically nylon/polyamide) into a solid structure based on a 3D model.

Direct Metal Laser Sintering (DMLS) - is a direct metal laser melting technology that forms accurate and complex geometries not possible with other metal manufacturing methods.

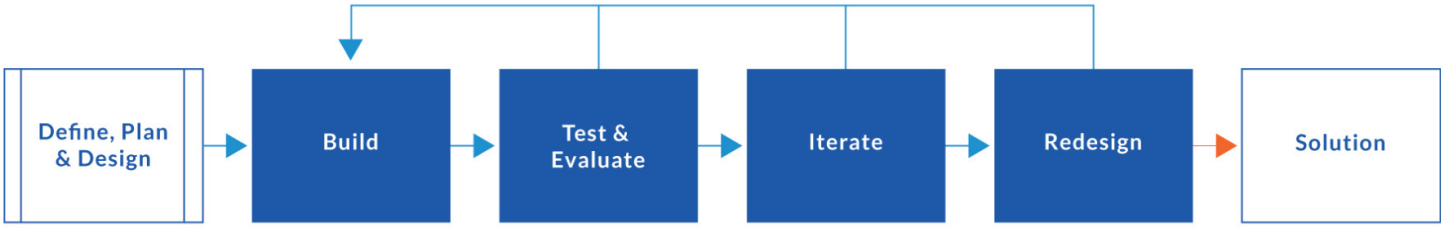
Fused Deposition Modeling - the most widely used method that uses a thermoplastic filament that's heated to its melting point and forced out, layer by layer, to create a 3D object.

Multi Jet Fusion - 3D printing process that produces functional nylon prototypes and end-use production parts as quick as 1 day.

Injection Molding - method to obtain molded products by injecting plastic materials molten by heat into a mold, and then cooling and solidifying them. Widely used process to create items like plastic trinkets, water bottles, cell phone cases, toys and more.

How Rapid Prototyping Fits into the Engineering Design Process

The engineering design process is the steps one goes through to solve a problem and provide a solution. In other words, it starts with a problem and ends with a solution.

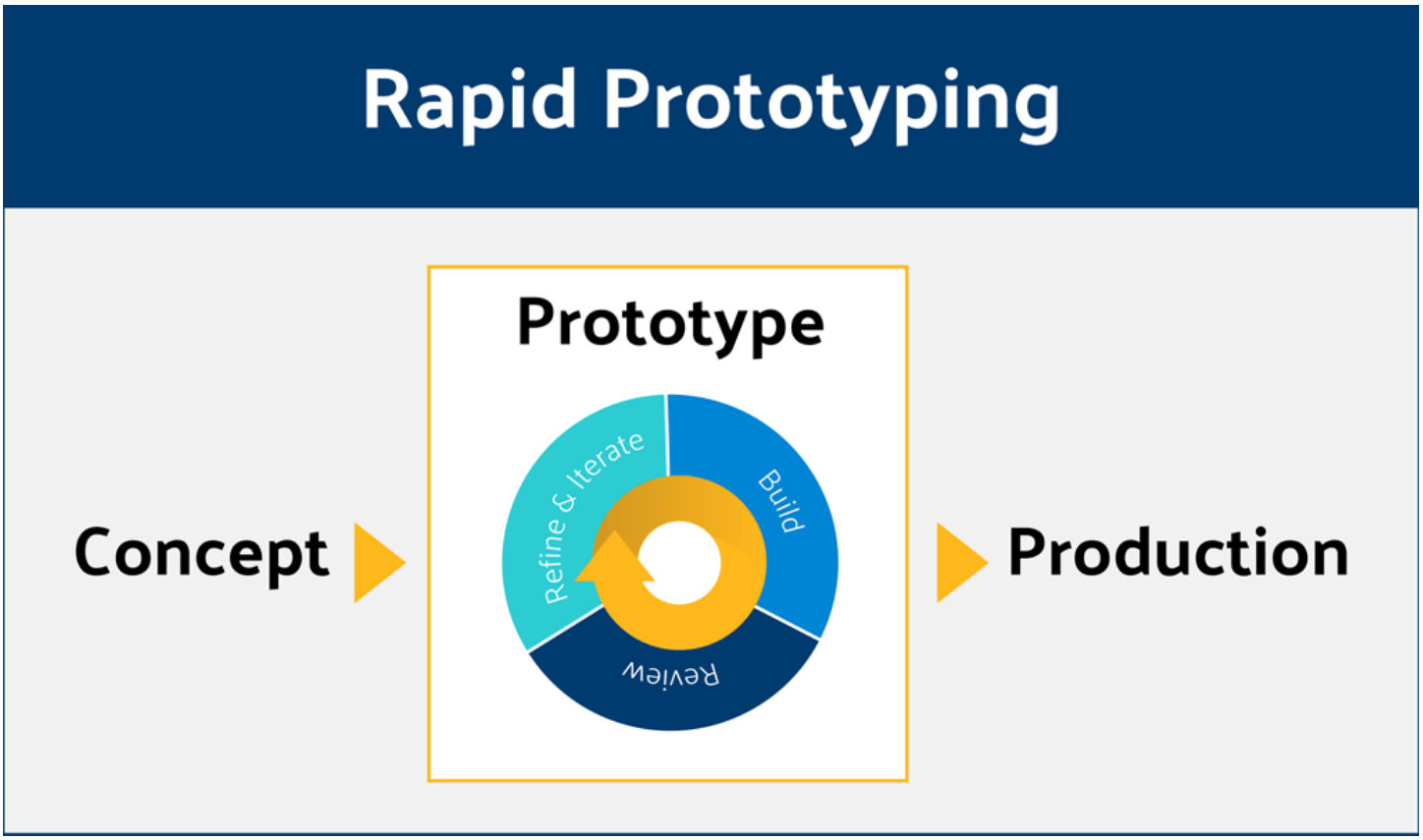


The steps can vary depending on your project but for the most part includes:

1. Define/Clarify
2. Plan
3. Design
4. Build a prototype
5. Test
6. Iterate
7. Redesign

It is a process that can be applied to any problem. Rapid prototyping fits into step 4 - *"Build a prototype"*.

To break it down further, RP would look similar to this image:



source: *http://engineeringproductdesign.com/knowledge-base/rapid-prototyping-techniques/*

Concept development involves identifying potential risks and setting a plan in action. The process is based on iterations that produce prototypes that will be tested and refined.

The goal is to agree on the look and feel of a design prior to production. The final step will be the manufacturing of the product with quality control processes in place.

Advantages of Rapid Prototyping

Product design failure in the development stage can cause a substantial loss for a company. Rapid prototyping is a cost effective way to develop and test an idea. The advantages of RP can produce a model to test the product for its performance and efficiency.

Here are 7 Benefits for Rapid Prototyping

1. Visualization of the design concept will give you opportunities to make quick changes or modifications.
2. RP can save time and cost which results in overall reduction of your time to market.
3. Designs can be more customized. Adjustments in design, materials, size etc.
4. Higher accuracy level in designing can help identify the flaws and errors before the manufacturing process begins.
5. Reduced waste
6. Allows functionality testing
7. Ability to evaluate the human factors and engagement

Conclusion

Rapid prototyping can reduce the time between iterations and allow engineers to discover inventive ways of solving any design engineering problems.

RP can be used at any stage of the product development cycle, but is most effective early in the process so that risks can be mitigated early and designs can evolve more efficiently. Prototyping helps make educational, informed decisions by gathering data from the performance and reaction to the different prototypes.