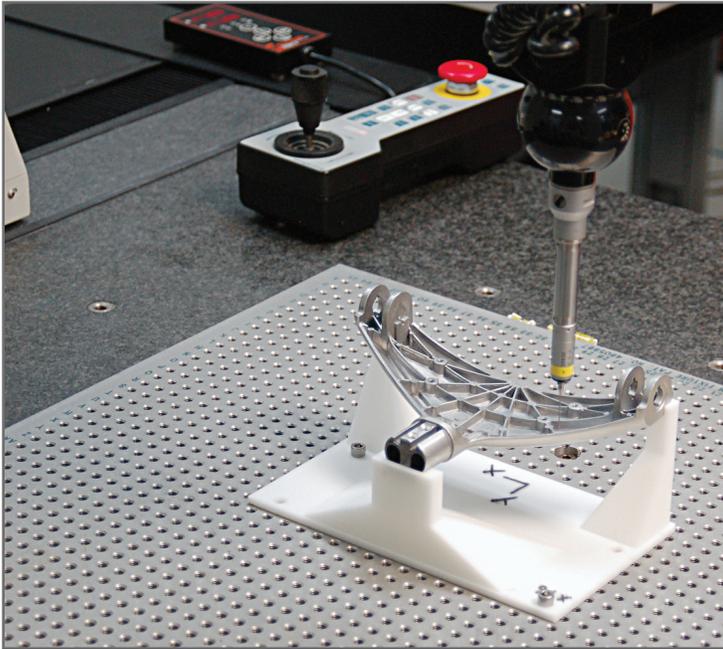


# IS NOW THE TIME TO TRY DIRECT DIGITAL MANUFACTURING?

**REAP MAJOR SAVINGS WITH THIS GROWING TREND.**

By Scott Crump, Stratasys, Inc.

Over the past 20 years additive manufacturing technology has migrated from use in rapid prototyping to a full-fledged manufacturing solution, which is referred to as “direct digital manufacturing” (or rapid manufacturing). Increasingly, companies are applying it to manufacturing applications, and with each success, they prove that it is a viable alternative. While the general concept of additive manufacturing is the same as when it was introduced 20 years ago, the change is in its intended use: production, not just prototyping. So, while the concept of direct digital manufacturing has been around for a while, in the minds of many, it can still be a new thing and sometimes difficult to understand.



Oreck uses direct digital manufacturing to create production aids, such as this fixture, which secures a component during CMM inspection.

## ADDITIVE MANUFACTURING

Additive manufacturing is the generic name given to processes that create a part by building it up in layers – as opposed to milling or machining, which are subtractive processes. Additive manufacturing was developed as a way to automate the creation of prototypes, and it was therefore originally known as rapid prototyping. It also goes by various other names, including 3D printing, which is one of the most popular.

Digital manufacturing is the process of using CAD or other data to drive an additive manufacturing machine that makes usable parts. Examples are the components that go into sellable products, pieces of production machinery, replacement parts or manufacturing tools, such as jigs and fixtures. Besides CAD data, which is the overwhelming majority of data used, other types of data may be used to drive additive manufacturing machines. Among others it includes 3D scan data (for reverse engineering) and DICOM data (for making a physical representation of 3D medical imagery).

Digital manufacturing eliminates molding, machining, casting and forming. Instead of material removal or shaping, a company's finished goods are produced by adding material one layer at a

time. Other than a few minutes of pre-processing to prepare a production run and some light post-processing to clean up a part, digital manufacturing progresses directly from CAD data to final part. Eliminating the up-front and back-end operations common to traditional methods means that there is no extraneous time, cost or labor.

## ONE PROCESS, MANY TECHNOLOGIES

Digital manufacturing is a process, not a technology. And it can be performed with various additive manufacturing technologies with diverse capabilities. The additive manufacturing technologies that perform digital manufacturing share the fundamental technique of producing parts directly from a CAD data file. However, additive manufacturing processes function in diverse ways; to determine digital manufacturing's suitability for your project, you must first evaluate the project against your chosen technology.

Whichever technology you choose, digital manufacturing offers powerful advantages over traditional manufacturing methods. The most often cited are:

- Eliminating investment in tooling.
- Speeding up design cycle and time to market.
- Expanded design possibilities.
- Quicker, less expensive redesigns.
- Custom parts and low-volume production.

Collectively, these benefits translate to efficiency, flexibility, responsiveness and affordability. Digital manufacturing is a manufacturing process that introduces alternatives in product design, manufacturing methodology and business operations. As an added benefit, many additive manufacturing technologies are fairly "green" processes. They produce very little waste compared to milling processes because they use only the material needed. No unnecessary inventory is produced because there is no benefit to building more than you need at any time. Most additive processes require no harmful chemicals and vent no harmful fumes into the environment. Additive manufacturing also requires

a relatively small amount of electricity to produce parts, another green benefit.

Digital manufacturing essentially rewrites the rulebook for making manufacturing decisions. In many instances, it is a polar opposite to conventional production methods. This makes it a disruptive technology and makes it more difficult to appreciate and comprehend.

## APPLICATION DIVERSITY

In the manufacturing environment, digital manufacturing often performs one of two roles. Companies can use the process to manufacture the products it sells or to make the devices that aid in the manufacturing of the products.

Digital manufacturing is best suited for low-volume manufacturing. However, even companies that focus on mass production can use digital manufacturing to save time and costs — every manufacturer has low-volume needs, such as hand tools, gauges and jigs and fixtures.

Producing manufacturing tools presents the ideal opportunity to try digital manufacturing. These tools are deployed to make manufacturing and assembly fast, efficient, repeatable and cost-effective. In this manufacturing context, digital manufacturing becomes a low-risk, high-return alternative to standard practices. Because the tools are used by the company, not the customer, and the time and cost to produce them is small, an unsuccessful attempt has little consequence. But when successful, digital manufacturing greatly improves productivity, quality and the cost of producing parts. Digitally manufacturing tools is currently more popular than using digital manufacturing for end-use parts. That's partly because it's such a low-risk opportunity, and partly because every manufacturer has a need for such tools.

Digital manufacturing benefits industries in addition to manufacturing as well. Because of the inherent need for custom

fitting devices such as orthotics, prostheses, hearing aids and dental bridges, the medical and dental professions have been early adopters of digital manufacturing. Companies have discovered that it can be a powerful alternative, rather than a direct replacement, to the conventional manufacturing processes.

Digital manufacturing presents a nearly limitless range of opportunities. Companies have only begun to uncover all that it can do. It is exciting to realize that the scope of opportunities and potential is enormous. It is also good news that there are so many technologies and materials from which to choose.

## IN SUMMARY

Digital manufacturing is a fundamental shift in the approach to making parts, which uses additive manufacturing to make end-use parts directly from CAD data. Digital manufacturing is a promising manufacturing alternative that accelerates production and reduces costs while creating new possibilities and new business models. It is unique because it avoids molding, machining and forming, and it eliminates the constraints that these conventional manufacturing methods impose.

Most likely, your company's product development department has either an in-house additive manufacturing system for rapid prototyping or it outsources prototypes to a service that uses additive manufacturing. In either case, talk with the design engineers in product development, and ask about a sample project. Ask if they will build you a simple manufacturing tool like a small jig, fixture or gauge. Compare the cost of digitally manufacturing the tool to the cost of producing it via traditional means: Think how this cost-effectiveness can benefit your company as it has many other leading companies.

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