

DIRECT DIGITAL MANUFACTURING: PRACTICING WHAT WE PREACH

By Scott Crump, Stratasys, Inc.

A MANUFACTURER OF ADDITIVE FABRICATION MACHINES LEARNS HOW TO EMPLOY DIRECT DIGITAL MANUFACTURING AND SAVES \$200,000 IN THE PROCESS.

Direct digital manufacturing (aka rapid manufacturing) is improving the productivity and profitability of companies around the globe. In the coming years, it will be as commonplace as molding, casting and machining. The companies that are profiting from it now are the ones that are open to change and willing to break from convention.

Stratasys is an organization that touts direct digital manufacturing (DDM), and yet, within our own company we were resisting changes to established manufacturing processes. Sure, we had fully embraced our own technology for prototyping, but its limited use to manufacture parts for our new machines was frustrating. We were not practicing what we preached.

It should not have come as a surprise. To some degree, every company struggles with change. While vital to progressive and aggressive companies, change can be difficult to facilitate. It seems that resistance to change grows along with the required effort or the perceived risk level. Add an aggressive deadline and no margin for error to the mix and the attitude becomes "If it ain't broke, don't fix it." Without intervention, current practices can become standard processes that seem to be carved in stone.

The solution to this dilemma was to change the mindset by taking action. For a recently released machine the design team was required to identify at least a few parts that could benefit from DDM

and then apply it. The support of management diminished the risk of breaking from status quo while rewarding positive change. This tactic allowed designers and engineers to experience the benefits and possibilities of DDM. They saw sharp reductions in tooling costs, design constraints and manufacturing lead times.

Our breakthrough came during the design of our newest high-end system, the Fortus 900mc. As the machine began to take shape, there was a revelation among our engineers — a realization that DDM isn't just for our customers, but it is a practical and powerful solution for our design and manufacturing teams as well. The change in attitude was palpable. Designers and engineers that were skeptical became enthusiastic. At the start of the program, the engineering team earmarked only three components for DDM. By the time the first machine shipped, it included 32 production parts built via DDM.

The first to embrace DDM was the industrial design team.

Scott Crump is founder and CEO of Stratasys, Inc., Minneapolis, a manufacturer of additive fabrication machines used for rapid prototyping, and direct digital manufacturing. Stratasys patented the process known as fused deposition modeling or FDM. The company supplied 44 percent of all additive fabrication systems installed worldwide in 2007, making it the unit market leader for the sixth consecutive year.



When told that they could shape the machine and its components without consideration of manufacturing constraints or availability of off-the-shelf items, creativity was unleashed and great ideas sprang up.

Not to be outdone, mechanical engineering quickly followed suit. Leveraging the freedom of design, engineering created components that would have been impractical due to tooling cost. In more than one instance, the final design would have been impossible to manufacture without DDM. Rather than designing for manufacturability, all efforts were dedicated to optimization. The team was free to implement the best ideas instead of what was traditionally considered the most practical. They also had more time to perfect the designs since machining and tooling were removed from the timeline. In a few instances, the rapid response capability turned last minute problems into easy fixes.

It is regrettable that words cannot convey the enthusiasm and excitement that are now a part of any DDM conversation among the design team. It is unfortunate that the sweeping changes to long-standing practices are difficult to quantify. There were numerous benefits realized in design, engineering and manufacturing, but many of them were immeasurable. Collectively, the benefits of DDM were much greater than the roughly \$ 200,000 saved by eliminating tooling and machining.

This was a tremendous learning experience. The design team learned the value of direct digital manufacturing and has been reminded of the benefits of change. Management realized that change might not occur without intervention and encouragement. Most importantly, we discovered that resistance to change may be the biggest obstacle to the adoption of direct digital manufacturing.

MORE INFORMATION

Contact a Stratasys by calling 800-937-3010 or visit www.Stratasys.com for more information.

FDM PROCESS DESCRIPTION

Fortus 3D Production Systems are based on patented Stratasys FDM (Fused Deposition Modeling) technology. FDM is the industry's leading Additive Fabrication technology, and the only one that uses production grade thermoplastic materials to build the most durable parts direct from 3D data. Fortus systems use the widest range of advanced materials and mechanical properties so your parts can endure high heat, caustic chemicals, sterilization, high impact applications.

The FDM process dispenses two materials—one material to build the part and another material for a disposable support structure. The material is supplied from a roll of plastic filament on a spool. To produce a part, the filament is fed into an extrusion head and heated to a semi-liquid state. The head then extrudes the material and deposits it in layers as fine as 0.005 inch (0.127 mm) thick.

Unlike some Additive Fabrication processes, Fortus systems with FDM technology require no special facilities or ventilation and involve no harmful chemicals and byproducts.

For more information about Fortus systems and materials, call **888.480.3548** or visit www.stratasys.com

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