Adding Additive Manufacturing to Your Toolbox

SHOULD ADDITIVE MANUFACTURING (AM) be in a shot peening facility's toolbox? I sought answers at a recent Additive Manufacturing Summit hosted by ITAMCO (Indiana Technology and Manufacturing Companies). A presentation by Bob Sutton, Managing Director with Springboard Engineering Solutions, was very useful to me. I'll share his input on the decision-making process when purchasing a 3D printer and the best uses for a printer today. Along the way, I will write about industry leaders in shot peening that are successfully using 3D printers.

DO YOU NEED A 3D PRINTER?

First, a reality check. Mr. Sutton advises manufacturers to not get caught up in the 3D printing hype. (He has decommissioned three 3D printers for clients in the past few years.) "Make a careful business decision based on a planned use case and calculated costs. Don't follow the glitz," said Mr. Sutton. He outlined the ways to avoid buyer's remorse including: 1. Matching your application with the appropriate 3D printer—no easy task—2. Realizing the hidden costs, and 3. Identifying the ways a printer will make or save money.

BUYING THE RIGHT PRINTER

Since AM is relatively new, matching the process and related machinery to an application can be overwhelming. At this time, there are seven main AM processes with subcategories in each:

1. Material Extrusion
2. Vat Photopolymerization
3. Powder Bed Fusion
4. Material Jetting
5. Binder Jetting
6. Directed Energy Deposition
7. Sheet Lamination

Mr. Sutton recommends careful research to find the ideal printer for your needs. Here are a few of the resources he likes:

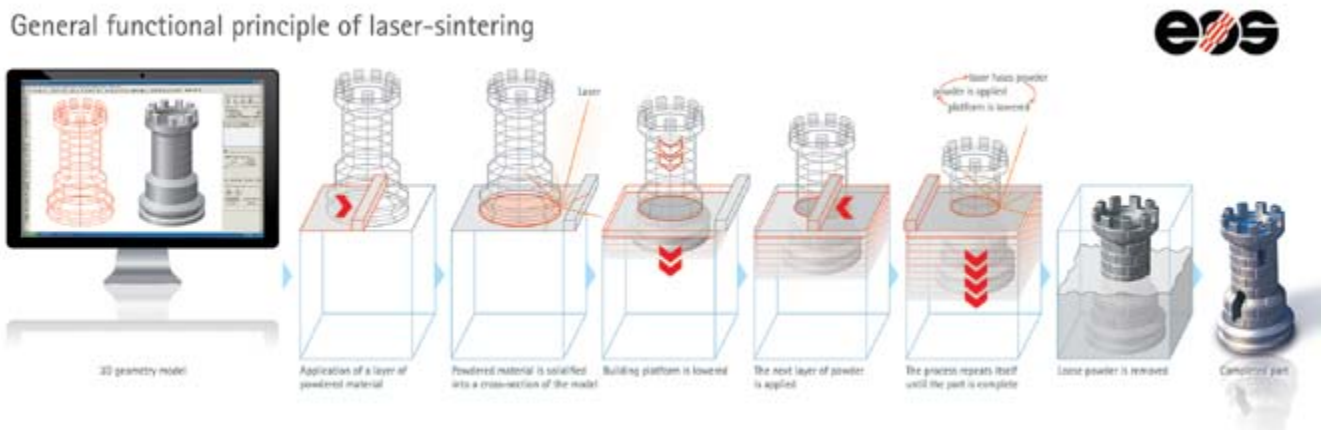
- TCT Magazine (www.tctmagazine.com)
- Rapid eNews (www.multibriefs.com)
- The 2020 Rapid + TCT Tradeshow

In addition, since companies in our industry are already using AM, I advise talking to OEMs, students and instructors at an EI shot peening workshop and tradeshow. Advice from someone that's already using AM is priceless.

THE COST OF OWNERSHIP

Many of a 3D printer's initial and ongoing expenses are like any capital expenditures. There are, however, a few unique start-up and ongoing costs of this equipment, including:

- Employee training and the learning curve – "Startup can be slow. Do not expect good parts the first day," said Mr. Sutton.
- File preparation software research, purchase price, and ongoing licensing fees
- Raw material shelf life
- Raw material disposal (many of these materials aren't recyclable)
- Utilities – "Did you notice how much power it pulls? That heat goes somewhere," said Mr. Sutton.
- Time and materials for post processing



Laser-sintering is a Powder Bed Fusion process. Laser-sintering is ideal for manufacturing because of its easy design process and it allows users to build complex geometries. Parts typically possess high strength and stiffness. (Image source: EOS)

- Quality control in part geometry and material properties
- Build plates and other consumables

SHOW ME THE MONEY

There are three uses for 3D printers that are common in our industry: Non-functional prototypes, functional prototypes and tooling. Mr. Sutton said, "If a picture is worth 1,000 words, a 3D-printed part held in the hand is worth a million." All the benefits of prototypes—fit-and-form checks, assembly space management, and good communication—can be realized quickly and efficiently. We can print metallic components, saving days, weeks or even months rather than waiting for a machine shop to fabricate a functional prototype. It's a cliché but it's still true: Time is money. In addition, many types of tooling can be made with AM and an exciting application is the ability to produce specialized tools that you can't buy.

Next, I will tell you about three companies that have successfully integrated AM into their workflow.

REAL-LIFE APPLICATIONS

ITAMCO

As early as 2012, ITAMCO was using their MakerBot 3D printer to replace plastic parts on equipment in their open gearing and machining facility. "Rather than ordering an expensive replacement knob from the machine OEM and waiting a long time for it, we make a new knob on the MakerBot," said Joel Neidig, Director of Research and Development at ITAMCO. In 2015, the company launched their "Strategic Technology Initiative for Additive Manufacturing." At the same time, ITAMCO was part of a group that received R&D funding from the National Center of Defense Manufacturing and Machining (NCDMM) to conduct research on the support structures used in additive manufacturing. They purchased an EOS M 290 additive manufacturing printer for the project and have continued to expand their AM capabilities. They developed the Atlas 3D software for 3D print designers and are working on several projects with the US Army, Department of Defense and the Air Force, including a confidential gearing project for the US Army. Closer to their facilities in northern Indiana, ITAMCO supplies additive-manufactured prototypes for local companies. "We are continually stretching our capabilities to cross new boundaries in additive manufacturing," said Mr. Neidig.

Electronics Inc.

The engineering team at Electronics Inc. (EI) wanted a 3D printer to make prototypes. After researching the options, they chose an Objet30 Pro by Stratesys. "A good example of how we use the printer are the prototypes we made for a modification on the 700-24 MagnaValve," said Bryan Chevrie, Product Engineer with Electronics Inc. "We wanted to change the blade angle on the valve so we tested prototypes of a new mount. We were able to find the ideal solution in a short period of time."

The engineers at EI began to see other opportunities for the technology. They now depend on it for tooling and fixtures. "The software and hardware are user friendly so it's easy to develop new uses for the printer. The only real learning curve was in optimizing the expensive print material," said Mr. Chevrie.

Progressive Surface

"We bought a 3D printer so we could rapidly print machine component geometry or part geometry. We wanted to test design concepts for machine features and evaluate clearances and access for process viability," said Jim Whalen, Vice President of Sales and Marketing for Progressive Surface. Mr. Whalen provided two examples of how 3D printers are used in machine design at Progressive.

1. We needed to determine if we had enough clearance to get a deflector lance into a complex part feature. We printed a sub-scale version of the complex part and an equally scaled robot-end effector. We could then determine actual deflector lance geometry to get access to the area that needed peening.
2. We utilize 3D printing to make part-holding tooling for prototype process application work.

Progressive began using 3D printers five years ago and they have upgraded to get improved software and capacity. Mr. Whalen has advice for anyone thinking of getting a 3D printer, "Understand what you intend to do with this tool so that you can establish the printing materials you will need. That will lead you to the right printing technology."

Author's Note: Don't miss the article from Colin McGrory, Technical Director with Sandwell UK, on page 10. Mr. McGrory was using Additive Manufacturing 20 years ago and he has good advice for anyone thinking of starting an AM program.

CONCLUSION

I trust I've made the case for Additive Manufacturing. ITAMCO, EI and Progressive Surface are successfully using the technology and I'm sure many of our readers are, too. Those of you in aerospace and medical might be working for companies that are making production parts with AM. Many job shops are shot peening additive-manufactured components. So as Mr. Sutton said, "A 3D printer is possibly the best and most flexible tool in the manufacturing engineer's toolbox. In fact, it's a whole new drawer in the toolbox."

About Springboard Engineering Solutions

Springboard Engineering Solutions offers expertise in a wide range of engineering services, including Additive Manufacturing, to help designers, inventors and manufacturers bring their products to market. Contact Mr. Sutton at (574) 514-4351 or bsutton@springboardengineers.com.