The Aerospace & Defense Forum

"Developments in Aerospace Additive Manufacturing"

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Presentation by

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If you were asked the question, "When did the use of additive manufacturing (AM), otherwise known as 3-D printing, first begin?" what would be your answer? Five years ago? Maybe 10? According to our presenter at March's Aerospace and Defense Forum meeting, Steve Kidd, additive manufacturing began 30 years ago. Today, and in very recent years, AM has finally "arrived," according to Steve. It is experiencing a rebirth.

The additive manufacturing industry is exploding, growing over 30% annually, with new applications and uses being applied every day. Some project that the global 3-D printing market will reach $8.6 billion . . . yes, billion with a 'B' . . . by 2020. Reports shared by Steve offer further evidence of the industry's rapid expansion –

- Sales of 3D metal printers grew over 75% in 2013;
- Two-thirds of industrial manufacturers use 3D printing; and
- as was predicted in Additive Manufacturing magazine, "3D printing will explode in 2014, thanks to the expiration of key patents."

All one needs to do is look at the primes and leading edge companies to see examples of the expanded use of additive manufacturing. Boeing uses 20,000 3D printed parts on their aircraft. No wonder that overall patent filings related to additive manufacturing has soared over the past decade by over 800%.

By 2018 Airbus expects to print 30 tons of metal parts every month using additive manufacturing. A&DF co-founder Ivan Rosenberg learned, while attending a tour of Space X, that they have major plans in place to use 3D printing in their production. Aerojet Rocketdyne, world-recognized aerospace and defense manufacturer, has become an AM industry leader, having successfully completed hot-fire testing of 3D printed rocket engine injectors.

So why are so many companies jumping on this bandwagon? The list of benefits using AM is robust . . .

- **Speed** - Compared with traditional methods, 3D printing can shave hours and even days off of production times.
- **Reliability** – Each part printed is consistent.
- **Cost Savings** – Savings are achieved both in production and as a byproduct of producing parts using lighter weight materials. Airbus expects to reduce overall aircraft weight by one ton producing 3D parts. Imagine the fuel savings, given that some believe there is a $10,000 savings annually for every one pound reduction.
- **Accuracy** – The more advanced 3D printers become, the closer printed parts will meet CNC tolerances. One part produced with an expected tolerance of .005 (five thousands) actually achieved a .002 tolerance.
- **Reduced Waste** – Traditional subtractive processes create waste. Additive manufacturing uses what is necessary.
- **Faster Response** – AOG. Aircraft on Ground. The worst nightmare for an airline. 3D printing can produce replacement parts more quickly than these parts could be sourced from the vendor.
- **Tooling Benefits** – The benefits reduce dependency on suppliers, possibly allowing manufacturers to bring tooling production in-house.
- **Efficiencies of Scale** –Steve shared a slide picturing a part produced by Washington-based supplier Custom Control Concepts. Before 3D printing, they needed to CNC 19 different metal parts to create a single assembled product. Today, using AM, they produce ONE complete part.
- **Retrofit Benefits** – How often do manufacturers lose molds . . . or find them damaged? They are either irreplaceable or cost a fortune to recreate. 3D provides a real, cost effective option to this replacement.

For all of the positives, AM is not an end all, be all, cure all. There are limitations. Currently, 3D printing is not economically feasible for most long production runs. It is much better for tooling and shorter runs. According to Steve, AM's "sweet spot" is tooling, i.e. the "parts necessary to make the parts" rather than producing the finished products.

Culture may also play a role inhibiting greater roll out of 3D technology. Many find comfort knowing that "this [use of CNC machines] is the only way we've done it" and therefore will resist change. As Steve stresses, 3D is not intended to replace traditional CNC use nor be appropriate for long production runs. But in its sweet spot, 3D will be of great value.

Before concluding his presentation, Steve shared stories of several unconventional uses of 3D printing. He showed a slide of a Shelby automobile, fully designed, manufactured and assembled using AM. There was also a slide depicting a Soap Box Derby car. But the most awe-inspiring to me was this:

Burn victims, to prevent, or at least reduce horrible scarring, need immediate pressure applied to the affected areas. For facial burns, doctors typically create a Plaster of Paris mask to apply that pressure, but it can take 12 hours to produce. Steve and Cimtech have designed a revolutionary process whereby a hospital can take an image of a burn victim's face and send

that image electronically to Cimtech. Within two hours a perfectly molded, 3D printed mask is on its way to the hospital.

As Steve asserts, “our imagination is the only limiting factor in the growth of this industry and application in our businesses.”

Lee Schwartz, former CEO and President of manufacturing and distribution companies, is principal of the Schwartz Profitability Group (SPG) that, for 14 years, has uncorked the operational bottlenecks of manufacturing and distribution companies, boosting their bottom line results. Lee’s clients range from smaller family run companies to Fortune 500 firms, including those in aerospace and defense. His work helps his clients find solutions related to process improvement, supply chain management, inventory control, workflow design, and operational performance. Results consistently include cost reduction, improved efficiencies and increased profitability.

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