What's in a Name?: "3D Printing" vs. "3D Manufacturing"

by
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Part 2 of a 2-part article

In part 1 of this article I asked whether "3D printer" is the best name for the category of machines that do 3D printing, additive manufacturing, or layered manufacturing. I concluded that "3D printing" and "3D printer" are adequate to describe today's technology, which makes mostly parts, not products, and does so mostly by layering.

3D printers make parts. As I discuss in my book, 3D Printing Will Rock the World, the parts can be highly customized and complex, and may yield part count reduction, but parts is parts.

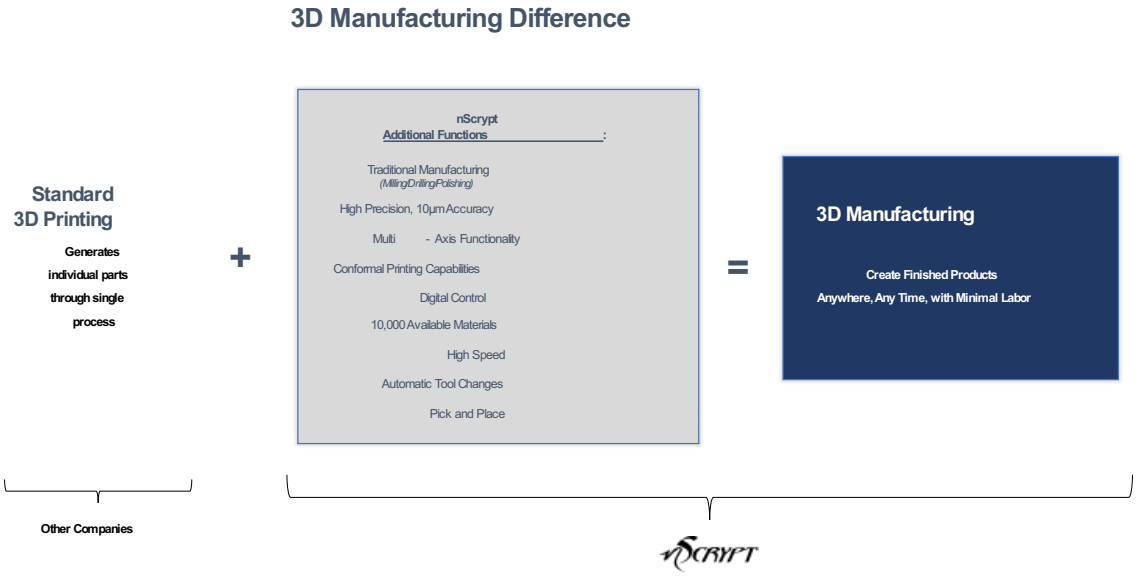
3D printers are generally limited to a single process, such as material extrusion, powder bed fusion, or binder jetting. The term "hybrid manufacturing" has been used to describe mostly 3D printers of metal combined with traditional metal-related manufacturing processes like milling and welding. All of these machines make parts.

But 3D printers or hybrids cannot make fully assembled complex products like electronic devices. Making electronic devices in a single machine is more complex and robust than printing and therefore "3D printing" is inadequate to describe all that these machines must be. "Printing" also connotes layers (as does "additive"). "Printing" may work for describing the process of making a part or even circuitry, but seems inadequate for fully functioning devices. Finding the right name for machines that make products, not parts, will not only help to drive their adoption, but can also help to shape what they will become.

There will probably always be a need for 3D printers because they are great at making parts that can't be made in any other way, reducing labor, and democratizing, distributing, and localizing the manufacturing of parts. But the next step beyond 3D printing and the next step in the future of manufacturing is to realize those benefits with systems that make fully functioning products, such as electronic products, and not just parts.

A natural name for such manufacturing is "3D manufacturing." It is the natural extension of "3D printing" as both a name and as a manufacturing method. So what would a 3D manufacturing system look like?

To make fully functioning devices in a single machine, with minimal labor, 3D manufacturing integrates more processes with a 3D printing component. The 3D printing component can make the structure or housing of the device, but that's as far as that process goes.



To make products, not just parts, a 3D manufacturing system is multi-material. It has the ability to build the product with several separate materials simultaneously and to incorporate hybrid materials made by the system on the fly. Such materials need to be plastic, metal, ceramic, rigid, flexible, opaque, translucent, transparent, conductive, insulating, aesthetic, etc., from a virtually unlimited palette, as the product designer chooses.

A 3D manufacturing system also incorporates milling and polishing, for example, to smooth out the layer lines of a 3D printed structure so that it can accept precision electronic traces. Milling and polishing are also needed to yield a fine surface finish of the completed device. Drilling is also needed. Pairing a material extrusion toolhead with a milling/polishing/drilling tool head, a 3D manufacturing system builds a fine structure for the finished device.

Electronic components cannot be 3D printed and many cannot be 3D manufactured, at least not yet. So a 3D manufacturing system also includes pick and place capability.

Traditionally manufactured electronic devices consist of a housing containing printed circuit boards (PCBs) and possibly other electronic components. The beauty of 3D manufactured electronic devices is that they no longer need to be electronics-in-a-box. Instead, the box can become the electronics. In other words, the electronics can be embedded in or on the structure, such as the circuitry and the components embedded in the cylinder shown below. In the finished device, another layer of material is extruded over the electronics, embedding them, making them invisible, and also protecting them. No box. No PCBs. In effect, the structure itself – the cylinder – becomes the circuit board.

To break the PCB-in-a-box paradigm, 3D manufacturing systems are also capable of making any shape structure with conformal circuitry, using surface mapping lasers and tool heads moving in multiple axes.

To compete with traditional processes rendered by multiple machines and their associated high labor costs (the assembly line), 3D manufacturing is also high speed, highly precise, digitally controlled, and happens in one machine with automatic tool changes and minimal labor.

Combining these processes and functionality, 3D manufacturing systems, which are the next step in the future of manufacturing, make any product, anytime, anywhere in a single machine with minimal labor. At this time, the only 3D manufacturing system I know of, which integrates all of these capabilities, is the nScrypt Factory in a Tool. But over time, 3D manufacturing systems will proliferate and become the norm.