



Additive Manufacturing

## How to Take a 3D Printed Part to Market in Aerospace

Don Sears | Oct 09, 2018

There are very good business reasons for venturing into 3D additive manufacturing in aerospace. See how one small startup brought one of its products to market in one year—with the help of key 3D printing partners and an exclusive license for a part that saves militaries money, and a lot of time. We spoke with Metro Aerospace and 3D Systems at IMTS 2018.

It's one thing to be innovative. It's another to bring that innovation to the marketplace—and do it rapidly. Can you cut down on operational manufacturing costs—and on capital expenditure investment—in an industry segment as compliance-rich and specification-heavy as aerospace? And can production at scale be met just yet?

A Dallas-based startup, **Metro Aerospace**, and its CEO, Leslie Peters, are determined to push through the barriers. Founded in 2016, Metro Aerospace delivered its “microvane” parts for military application on C-130 planes—and began shipping them to the Royal Canadian Air Force—in roughly seven month's time. The parts are also used by the Australian Air Force and the U.S. Coast Guard. The company **won a Laureate Award** from *Aviation Week* in the supplier innovation category in 2017.

But it did not do this alone. Design, engineering and manufacturing partnerships with Skunk Works and 3D Systems are crucial to its success. **3D Systems** is a global provider of additive manufacturing solutions and services. We recently spoke with Peters and Bryan Newbrite, an advanced aerospace applications engineer at 3D Systems, who presented their experience and best practices for bringing 3D printing applications and manufactured parts to conference session attendees at **IMTS 2018**.

## Dispelling 3D Printing and Additive Manufacturing Myths for Aerospace

For starters, it's not a Star Trek replicator, relays Bryan Newbrite, an advanced aerospace applications engineer for 3D Systems. You cannot just push a button and then obtain a part.

"Honestly, it's like ramping up any kind of shop with new technology," says Newbrite. "There's a tremendous amount to learn."

There's also plenty of technology needed to make sure you get the part right. You cannot simply purchase a printer and expect it all to magically happen. There's an understanding of materials and how to build them using the right techniques with additive.

"If you don't get the production build configuration exactly right, you may get thin walls or warping," says Leslie Peters, CEO of Metro Aerospace. "You may need post-processing equipment and clean rooms, you may need to cure it with heat treatment ovens, and require paint booths... And there's all the CMM and testing machines, and the people who know how to load them."

Another misconception? That if it's 3D-printed it won't meet standards. Aviation in particular has rigorous testing and engineering requirements.

"These parts are made to very stringent tolerances, density specification and tensile strengths," says Peters. "There are many very small ranges that we have to conform to."

### Why This Specific 3D Printing Application Makes Perfect Business Sense

What are microvanes exactly? They are small aerodynamic components that reshape the airflow around the aft cargo door—and are designed not to interfere with cargo air drop or parachuting operations. Microvanes are made of a very lightweight, noncorrosive, durable polymer composite that includes glass and nylon bead.

"Microvanes generate airflow swirl in directions that are opposite to natural aft fuselage vortices," says Peters. "They reduce the total drag on the aircraft, making it more fuel-efficient and allowing for less thrust than without them."

This means mission times and mission ranges can increase—with less takeoffs and landings needed. It also cuts down on engine wear and widens the window for maintenance. These parts can also be retrofitted on existing cargo planes to extend their life.

Microvanes have been tested for over 10 years by the U.S. Air Force and U.S. Coast Guard. Metro Aerospace has the global exclusive license to manufacture the parts, under patents owned by Lockheed Martin. A shipped set of microvanes comprises 20 parts—and each part is approximately 9 inches by 2 inches by 2 inches. They are quickly installed either on the flight line or under maintenance in one day by surface mount bonding to both sides of the fuselage.

## Injection Molding vs. 3D Printing Applications: Total Cost of Operation

Why not use traditional injection molding to make these parts? Time, effort and production. At this point, Metro Aerospace can have microvanes produced additively and shipped to its military clients in six weeks or less. It can have spares ready in two to three weeks. Additionally, the selective laser sintered nylon materials have mechanical and thermal properties that are comparable to or exceed injection-molded plastics.

On the effort front, the engineering work with 3D Systems allows Metro to use outsourced expertise while getting to market relatively quickly. It will give the company time to build its own larger brick-and-mortar operation down the road—and hire the right kind of aerospace talent needed to scale for its future.

“I worked with engine manufacturers, and we could have up to 24-month lead times on the material and 12-month lead times on parts,” says Peters. “So the customer isn’t getting their part for three years, effectively.”

That’s a lot of time. In aviation, the U.S. Air Force and Navy are used to some horrible lead times too, Peters explains.

“Once we’ve passed all our certifications and we’re making the parts, we can produce them pretty quickly,” says Peters. “A four- to six-week lead time is nothing for most military operations. They generally cannot schedule downtime for their air fleet in that time.”



Finishing the microvane. Image provided by Metro Aerospace

Relatively short lead times help reduce parts kept in inventory, so MRO overhead is lowered—which gives an already volume-heavy aerospace supply chain some relief.

“You’re much more in a just-in-time delivery sequence similar to automotive requirements,” says Peters.

But there’s also something to be said for managing to the OEM’s specification needs and changes. To a company such as Metro, iteration delivery matters to the bottom line. Newbrite says most aerospace manufacturers see design iteration timelines of eight to 18 months—but 3D systems own engineering work yields in the one- to four-month timeline, which means parts in flight faster and new orders coming in more quickly. 3D Systems uses many materials in additive, including over 100 plastics—and many nylons, metals, waxes, ceramics and other composites.

## Managing to Aerospace Standards and Regulations—and Investing for the Future

The key thing to understand in aviation is that quality standards are very rigid. Peters knows this from her time working on jet engines for GE Rolls-Royce and United Technologies.

“I wanted to ensure whoever I was using in my manufacturing process was AS9100 certified,” says Peters. “And then because we are a startup company, likewise, we secured Metro’s AS9100D certification as well this year.”

Interestingly, she says the aerospace standards on the specification side are not as rigid for additive as they are in other manufactured parts. They are being developed—and those in the industry pay attention to the consortiums and closely monitor *SAE International standards*, Peters explains.

***Want to dive deeper into aerospace standards? Read “In Aerospace, May the AS9100 Standard, Specification and Certification Be With You.”***

Did they encounter any regulation or standards roadblocks? No. Lockheed Martin has over 10,000 production parts on 90 different programs that are 3D-printed. In her opinion, this is no longer “novelty for aerospace.”



Microvane technology is trademarked. Image provided by Metro Aerospace.

Metro has to adhere to all of the specifications of Lockheed Martin, so yes, the level of audit and inspection is of paramount importance under quality control—just like the rest of aerospace and defense manufacturers. But even in the initial review process, time was saved. It usually takes aerospace manufacturers six to nine months for the “first article”—which is the very first inspections and audit of the very first production parts that are made. Metro did it in two months.

Metro’s partnership with 3D Systems, which has its AS9100 certification, makes good sense too. 3D Systems uses a selective laser sintering process for making the parts.

“They have the technicians, they have the machines, the material, so it makes sense to me,” says Peters. “I’m going to leverage the capacity that’s out there for my initial demand. And then that gives me time to get my people educated to get the brick-and-mortar setup.”

Peters has big plans too: going after the Federal Aviation Administration and commercial jetliners—which is a big investment, but one she and her partners expect will reap rewards. In the near term, the company hopes to be manufacturing similar microvane parts for Boeing’s C-17.

***What has your experience been with 3D printing and additive manufacturing? Share with your peers.***

