

Metro Aerospace Introduces 3D Printed Part for Fuel Efficiency in Aerospace

SLS 3D printed aerospace parts can provide a fuel savings of 4% at cruise with improved aerodynamics and reduced drag



In the aerospace industry, the slightest design improvement can have a staggering impact on the efficiency of flight, which is why aerospace manufacturers dedicate tremendous time and talent to advanced engineering. Sometimes small modifications pay off big time, as is the case with the new 3D printed microvanes, a drag-reduction and performance enhancement technology recently commercialized by Texas minority-owned business Metro Aerospace. Developed for the C-130/L-100 aircraft, the microvanes are adhesively fastened on both sides of an aircraft's fuselage and are designed to reduce drag by reshaping airflow around the aft cargo door.

3D Systems' On Demand Manufacturing team helped Metro Aerospace take the microvanes from a prototype into a production part with uncommon speed. Offering production support at any stage of product development, 3D Systems' On Demand Manufacturing experts deliver quick, high quality parts ranging from fast turn and advanced prototypes to appearance models and low volume production. Using Selective Laser Sintering (SLS) and DuraForm® GF, a glass-filled nylon, 3D Systems' On Demand team in Tulsa, OK, worked closely with Metro Aerospace to successfully complete a first article inspection report. This validated that all manufacturing requirements and part specifications were executed exactly as prescribed on qualified SLS machines.

CHALLENGE:

Deliver a highly regulated, patented design from a prototype to a production part, complete with necessary inspections and reports, all within a short period.

SOLUTION:

3D Systems' On Demand Manufacturing service experts and selective laser sintering (SLS) technology with glass-filled nylon material (DuraForm® GF).

RESULTS:

- 18 production microvane ship sets, 360 parts, delivered within 2 months
- Successful first article inspection & report
- Repeatable additive manufacturing process for future demand
- High customer satisfaction under stringent AS9100 quality requirements

3D printed part reduces drag, introduces savings

Delivered in ship sets of 20, the 3D printed microvanes are each about 10 inches long and each one different. According to Metro Aerospace, these additively manufactured and carefully engineered attachments can reduce total drag by approximately 15 points. The company further indicates that the simple incorporation of these structures can lower fuel consumption by approximately 25 to 30 gallons per hour while also providing significant reduction on inboard engine wear. Though micro in size and name, this is a major impact for such a minor modification.

For commercial aircraft, the SLS printed microvanes mean a desirable improvement in fuel economy, and for military aircraft they provide the added benefit of extended time on mission and additional payload capacity, tremendous advantages to each respective use. The microvanes can be installed on new aircraft or easily retrofitted on existing without any structural modifications and produce no operational impact apart from the desired drag reduction.

Leslie Peters, President and CEO of Metro Aerospace, says purchase and installation of the microvanes can deliver a return on investment in under a year based on achievable fuel savings.

Combined with this rapid ROI, the ease of installation and minimal aircraft downtime make the microvanes an incredibly cost effective improvement to large cargo aircraft. For Metro Aerospace, using 3D printing for production and working with 3D Systems' On Demand Manufacturing team has enabled a compelling business model to free the start up from stocking parts while still enabling quick and high quality order fulfillment.

3D printing expertise for production confidence

Metro Aerospace chose 3D Systems as its on demand manufacturing partner based on the company's expertise and leading technology in the additive manufacturing space as well as with the microvanes themselves.

"Additive manufacturing is fairly new, and it's very new in aerospace for high volume exterior aircraft components," says Peters. In order to quickly transition the microvane from a prototype to production parts, Metro Aerospace relied on 3D Systems' familiarity with the aerospace industry and exposure to the microvane design that it gathered from working through the prototyping phase.

Peters is quick to point out that transitioning from a prototype to a final product is not always straightforward, especially in the aerospace industry. "Going from prototyping to production is not as easy as people think," she says. "It's not just turnkey. There's a lot more involved."

The final 3D printed microvanes had to meet all of the rigorous standards outlined by the engineers who designed them, as well as undergo a first article inspection and report (FAIR) with thorough documentation, as is commonplace in the aerospace industry. 3D Systems and Metro Aerospace worked closely throughout the



process to ensure that every detail was minded and met with full attention and care, starting with printer qualification and material testing through to part labeling, finishing and shipping. The two companies also partnered to meticulously record a process control document and verification to satisfy the stringent requirements of delivering a new product within such a highly regulated space.

According to Peters, the speed at which everything was achieved by working with 3D Systems was exceptional. "Sometimes a FAIR will take six months alone before you can even start your manufacturing, but within three to four months we were approved and shipping product for a foreign military," she says. "In terms of speed to market in aerospace, that's very, very fast."

Proven experience in aerospace

3D Systems brought a high level of experience and qualifications to the table to make production 3D printing possible within a tight timeframe. ITAR and AS9100 certified, 3D Systems' On Demand Manufacturing facility in Tulsa, OK, had proven through its high quality prototyping work that it could also be confidently trusted to deliver an accurate final product at production volumes.



Producing quality aerospace parts is an involved undertaking using any manufacturing technique, and 3D printing is no different. 3D Systems' team worked closely with Metro Aerospace to qualify the SLS production machines, conduct tensile and density testing on the material both in-house and through a third party, and follow the microvane finishing protocol to the letter. 3D Systems ticked all the boxes for Metro Aerospace to get off the ground successfully. "You need special equipment, you need special rooms and you need a company that is qualified in managing the whole process as well as the product," Peters says.

With proper documentation and processes in place, fulfilling orders with 3D Systems' On Demand Manufacturing is streamlined and efficient, allowing Metro Aerospace to quickly answer the needs of its customers.

3D printing production capacity and attentive service

Speed to market was an important factor for Metro Aerospace, and the facilities and capacity available through 3D Systems were integral in making quick delivery possible. From beginning to end, 3D Systems' on demand team was fully committed to Metro Aerospace with an open and transparent line of communication to facilitate part quality and production expediency.

"They're really dedicated, hardworking folks," Peters says of 3D Systems' production specialists. "They even worked weekends for us when we needed to get something done."

The successful implementation of the SLS printed microvanes has given way to further explorations in 3D printing for Metro Aerospace in the form of microvane installation fixtures. Engineered to foolproof microvane attachment, Peters is again working with 3D Systems' On Demand Manufacturing team to bring this component to market after her company's positive experience throughout microvane production.

Whether you need fast turn 3D printed parts, advanced prototyping with assembly and finishing services, appearance models or low volume manufacturing including CNC, urethane casting and injection tooling, 3D Systems' On Demand Manufacturing services can help advance your project, timeline and goals.

Contact 3D Systems' in-house experts for more information on its complete On Demand Manufacturing services.



3D Systems Corporation
333 Three D Systems Circle
Rock Hill, SC 29730
www.3dsystems.com

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