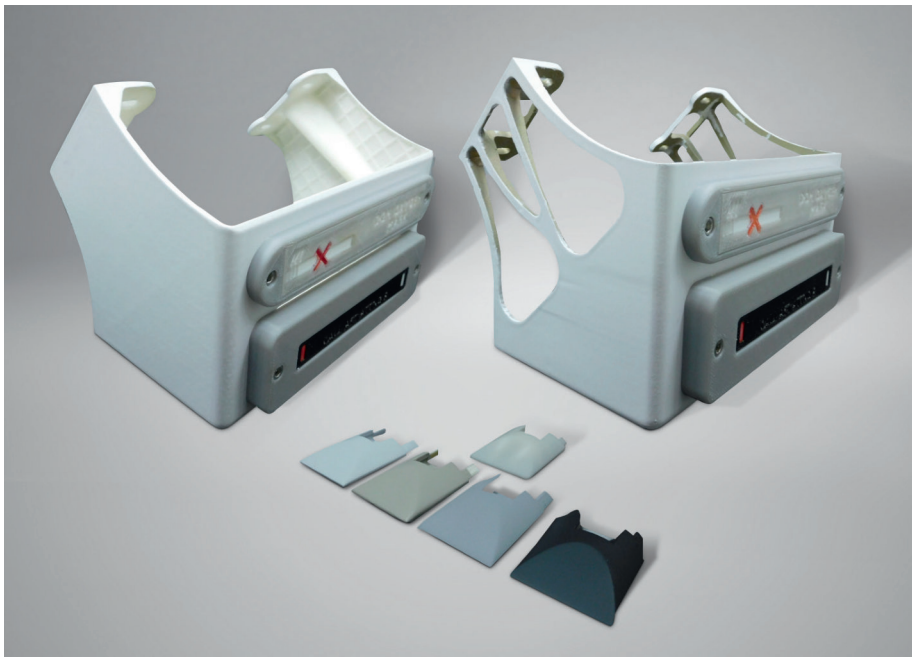
Success Story
Aerospace

ST Engineering

Certified Airworthy 3D-printed Cabin Interior Parts as Better MRO Solutions

Source: ST Engineering



We have what you are looking for: ST Engineering and EOS have qualified systems and materials to 3D print certified parts that are more durable and more effective in operations.

Challenge

Qualifying processes and materials to produce a wide range of certified, airworthy aircraft parts

Solution

Additive manufacturing using PA2241FR processed by EOS P 396 and EOS Aluminium AlSi10Mg processed by EOS M 290

Results

Certified: Proprietary workflow and processes with LPB additive manufacturing technologies validated by aviation authorities through STC certification campaign

Integrated: Assembly consolidation to lower part count

Faster: Shortened lead time with on-demand printing of certified print files

More Reliable: Design improvements that increase durability in operations

Lighter: Up to 50 % weight reduction as compared to original assembly

EOS

ST Engineering Introduces Certified **Additively Manufactured Cabin Interior Parts with EOS Industrial 3D Printers**

ST Engineering's Aerospace sector has been building its portfolio in virtual inventory to enhance customers' air operation performance, including solutions for commonly damaged aircraft components. Printing on demand helps eliminate waste when platforms are retired, reducing non-moving inventory. In addition, with approved digital files and qualified 3D printers & processes, certified parts can be produced close to aircraft sites, vastly reducing delivery-related carbon emissions and improving cost efficiencies.

Confident that additive manufacturing (AM) is the way forward, ST Engineering collaborates with technology partners and like-minded airline customers to develop multiple AM solutions. ST Engineering shares how they successfully broaden and deepen their capabilities as the leading AM solution provider.

Challenge

Back in 2018, ST Engineering already had plans to expand their AM capabilities from Filament Layer Manufacturing (FLM) technologies to include Laser Powder Bed (LPB) technologies - covering the two processes of Selective Laser Sintering (SLS) and Direct Metal Laser Solidification (DMLS) - so as to offer a wider range of additive manufacturing solutions to customers.

Originally, ST Engineering only had Design Organization Approval (DOA) and Production Organization Approval (POA) from the European Union Aviation Safety Agency (EASA) for FLM technology. For the LPB technologies, the plan was to build in-house capabilities in managing and qualifying the systems, materials and processes, which would in turn open more application potential to produce AM aircraft parts.

As a new adopter of LPB AM technologies, ST Engineering decided to collaborate with EOS, one of the industry's pioneering leaders specializing in LPB AM systems, to jumpstart their learning curve in understanding the possibilities and limitations of both SLS and DMLS processes.

ST Engineering has delivered and fielded various additively manufactured parts and equipment mounts, including the parts/ assemblies shown in the image. (Source: ST Engineering)

Short Profile

ST Engineering is a global technology, defense and engineering group specializing in the aerospace, electronics, land systems and marine sectors. The Group's aerospace sector provides integrated aerospace services and solutions through a global network of facilities and affiliates in the U.S., Asia Pacific and Europe, supporting a broad customer base that comprises leading airlines, airfreight operators and armed forces.

Further information
www.stengg.com/en/aerospace

As a trusted partner, EOS offered strong support and robust systems, providing good case studies and best practices in terms of stability and reliability.

Solution

By the end of 2018, ST Engineering and EOS' consulting arm, Additive Minds, established an Additive Manufacturing Capability Transfer Program. The program comprised customized training and consulting workshops that aimed to build strong fundamentals among attendees in the following topics: parts screening and selection, design for AM, business case analysis, and introduction on critical-to-quality requirements for AM processes.

After the Capability Transfer Program, ST Engineering selected a load-bearing cabin interior assembly with no impact on flight safety from their converted freighter aircraft as a benchmark to kick-start their adoption journey with both SLS and DMLS technologies.

For the selected assembly, ST Engineering decided to work with the following manufacturing processes and materials. As a metal, the EOS M 290 system and EOS Aluminium AlSi10Mg material were selected. As a polymer, the EOS P 396 system and EOS PA2241FR, a flame-retardant polyamide-12 (nylon) material, were selected.

After training the in-house team and through further collaboration, ST Engineering established a proprietary workflow and processes for both SLS and DMLS systems, encompassing design for AM, complete printing process control from powder management, printing execution, inspection and continued printing operation to post-processing, until the finished AM parts are ready for aircraft installation. The process specifications were demonstrated through an aviation qualification campaign to show their consistency, reliability and robustness in attaining design values up to B-basis statistically. Full proof load tests were conducted to verify the performance of the completed AM parts, and results in conformance with expectations were demonstrated.

> "Taking a part from design to deployment on aircraft is not easy. By developing proprietary work processes together with our partners at EOS, ST Engineering can introduce the benefits of additive manufacturing to the aviation world quickly and effectively."
>
> *Dr Zheng Guoying,*
> *Director, AM Development Centre, ST Engineering*

Results

In less than two-year time frame from 2018 to 2020, ST Engineering succeeded in setting up and implementing their own proprietary workflow and processes with LPB additive manufacturing technologies, having successfully obtained the following certifications:

- **EASA:** Supplementary Type Certificate (STC) on parts using SLS* and DMLS** Design Organization Approval (DOA) for SLS and DMLS in addition to FLM Production Organization Approval (POA) for SLS and DMLS in addition to FLM
- **FAA:** Parts Manufacturer Approval (PMA) on cabin parts (approaching final phase)
- **CAAS:** DOA & POA (approaching final phase) for additively manufactured parts using FLM, SLS and DMLS

The use of AM brings about a shorter turnaround time for parts replacement while providing an excellent alternative solution to high-cost, low-volume spare parts. ST Engineering's combined experience in engineering, and now additional certification, means they can meet the stringent aviation requirements when obtaining approval to install new AM parts in aircraft.

With their expanded capabilities, ST Engineering is embarking on bespoke AM design projects that not only help customers refurbish their commercial and military aircraft, but also improve component performance and order lead time.

* SLS – Selective Laser Sintering technologies with the EOS P 396 system

** DMLS – Direct Metal Laser Solidification with the EOS M 290 system

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