asco
EXCELLENCE IN AEROSTRUCTURES

SLM SOLUTIONS

Case Study

Gooseneck Krueger Flap Actuation Bracket

Component optimization at ASCO Industries in the course of the AFLoNext Project

3D-Printing Success Story

REDUCED BUY-TO-FLY-RATIO

and significant reduction of machining time

SIGNIFICANT WEIGHT REDUCTION

and reduction of assembly time

Part data

Designation:	Gooseneck Bracket
Industry:	Aerospace
Material:	Ti6Al4V
Layer Thickness:	30 µm
Build Time:	1d 19h 11min (full load, 2 pieces)
Machine:	SLM®280 Twin

SLM®280

Current Situation

Structural component from a Krueger flap actuation mechanism

Krueger flaps are considered a viable alternative for slats on the leading edge of an aircraft for future laminar wing platforms. The gooseneck bracket is a structural component from a Krueger flap actuation mechanism designed by ASCO in the scope of the AFLoNext project.

The bracket functions as a hinge between the Krueger flap and the fixed leading edge. Its elegant shape is the result of stringent space allocation requirements and high interface loads. Initially designed for machining by ASCO, the machined version of the bracket is made of high strength, corrosion resistant steel and weighs 2005g. The complicated manufacturing process and poor buy-to-fly ratio of the component made it a taget for optimization.

Innovations with Selective Laser Melting

Joint optimization project

The single-piece rocket propulsion engine, combining the injector and thrust chamber, reduces numerous individual components into one, with multi-functional lightweight construction achievable only with the selective laser melting process.

The internal structure developed by CellCore is the fundamental element of the engine and cannot be manufactured by traditional methods. It is not only suited for heat transport, but also improves the structural stability of the component. The cooling properties of the CellCore design considerably outperform conventional approaches, such as right-angled, concentrically running

Redesign of the gooseneck bracket

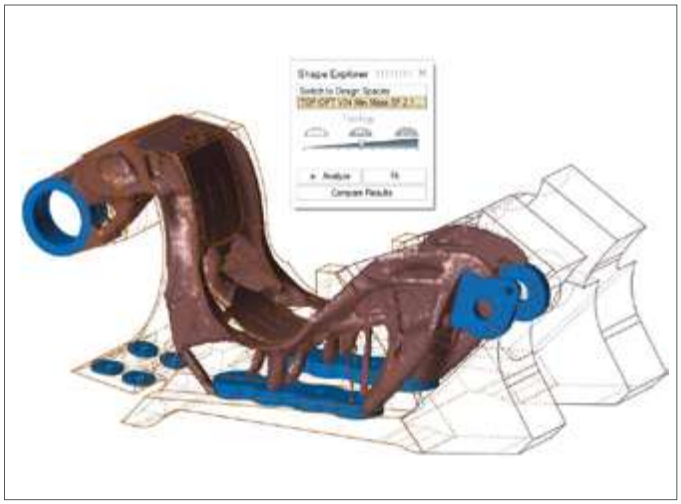
Since there is little added value to print a part that was designed for machining, the gooseneck bracket was redesigned for with the design principals of Design for Additive Manufacturing (DfAM), utilizing topology optimization. The target of the optimization was to minimize the weight while achieving the necessary strength to withstand the aerodynamic loads defined in the AFLoNext project. Moreover, two additional parts were integrated into the final component. The previous assembled component weight 2050g, which was reduced to 1416 g through additive manufacturing, saving 31% in weight while also reducing total assembly time.

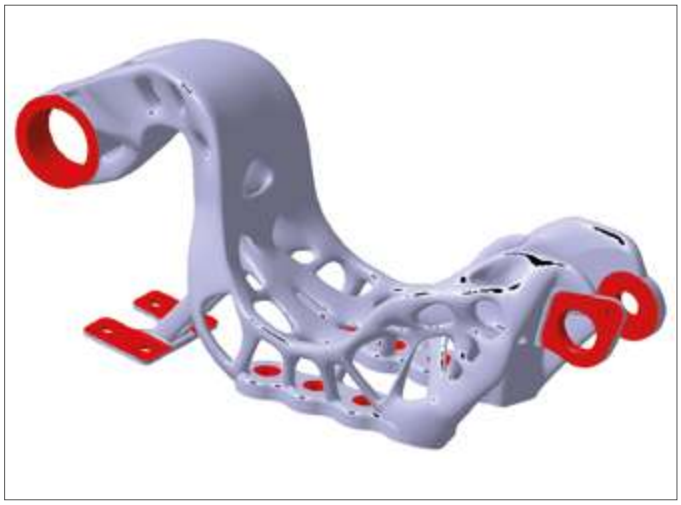
Improved buy-to-fly ratio

The buy-to-fly ratio of the machined version was around 17, while the SLM® component dropped the buy-to-fly ratio drops to 1.5, accounting for the support structures to be removed in post-processing and the small amount of extra material necessary for post-machining the interfaces with a tight tolerance.

Reduced machining time

The machining time, starting from a block was around 4.5 hours. Built with selective laser melting, it is only necessary to machine the few interfaces highlighted in red during the post-processing steps after the additive build.





ASCO Industries n.v.

ASCO is a Belgian aerospace company located in Brussels. It is recognized as a world leader in the development of mechanisms for the actuation of slats (Leading Edge) and flaps (Trailing Edge) and in the machining of high strength steels, titanium and aluminum alloys. ASCO is also known for its extensive capabilities in manufacturing and assembly to create precision and cost effective solutions for landing gears and structural components, such as fuselage frames and engine attachments.

Summary

Gooseneck krueger flap actuation bracket

- ASCO is the world leader in the development of mechanisms for the actuation of slats and flaps
- 31% weight savings plus a reduction of the total assembly time
- Integration of three parts into one reduced assembly
- Buy-to-fly ratio reduced from 17 down to 1.5
- Significant reduction of machining time
- 42% reduction of build time using a SLM®280 Twin, compared to single-laser machines

AFLoNext-Project

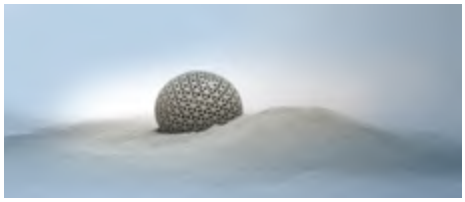
The work described in this case study and the research leading to these results received funding from the European Community's Seventh Framework Programme FP7/2007-2013, under grant agreement n°604013, AFLoNext project.

SLM Solutions - Technology Pioneers, Innovation Leaders

SLM Solutions helped invent the laser powder bed fusion process, was the first to offer multi-laser systems and all selective laser melting machines offer patented quality, safety and productivity features. Taking a vested interest in customers' long-term success in metal additive manufacturing, SLM Solutions' experts work with customers at each stage of the process to provide support and knowledge-sharing that elevate use of the technology and ensure customers' return on investment is maximized. Optimal paired with SLM Solutions' software, powder and quality assurance products, the SLM® technology opens new geometric freedoms that can enable lightweight construction, integrate internal cooling channels or decrease time to market.

A publicly traded company, SLM Solutions Group AG focuses exclusively on metal additive manufacturing and is headquartered in Germany with offices in China, France, India, Italy, Russia, Singapore and the United States and a network of global sales partners.





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