SLM SOLUTIONS

Case Report
Gooseneck Bracket

asco
EXCELLENCE IN AEROSTRUCTURES

Additive Manufacturing of an Aircraft High-Lift Actuation Device

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

COMPANY PROFILE

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.

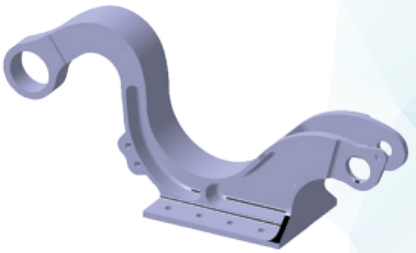
CURRENT SITUATION / CHALLENGES

AFLoNext Project

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

Structural component from a Krueger flap actuation mechanism

The Gooseneck Bracket is a structural component from a Krueger flap actuation mechanism designed by ASCO in the scope of AFLoNext. Krueger flaps are considered a viable alternative for slats on the aircraft leading edge, for future laminar wing platforms. 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. The bracket was initially designed for machining by ASCO. The machined version is made of high strength corrosion resistant steel and weighs 2005 g. The interest in this component arises from the fact that the initial version is complicated to machine and has a poor buy-to-fly ratio.

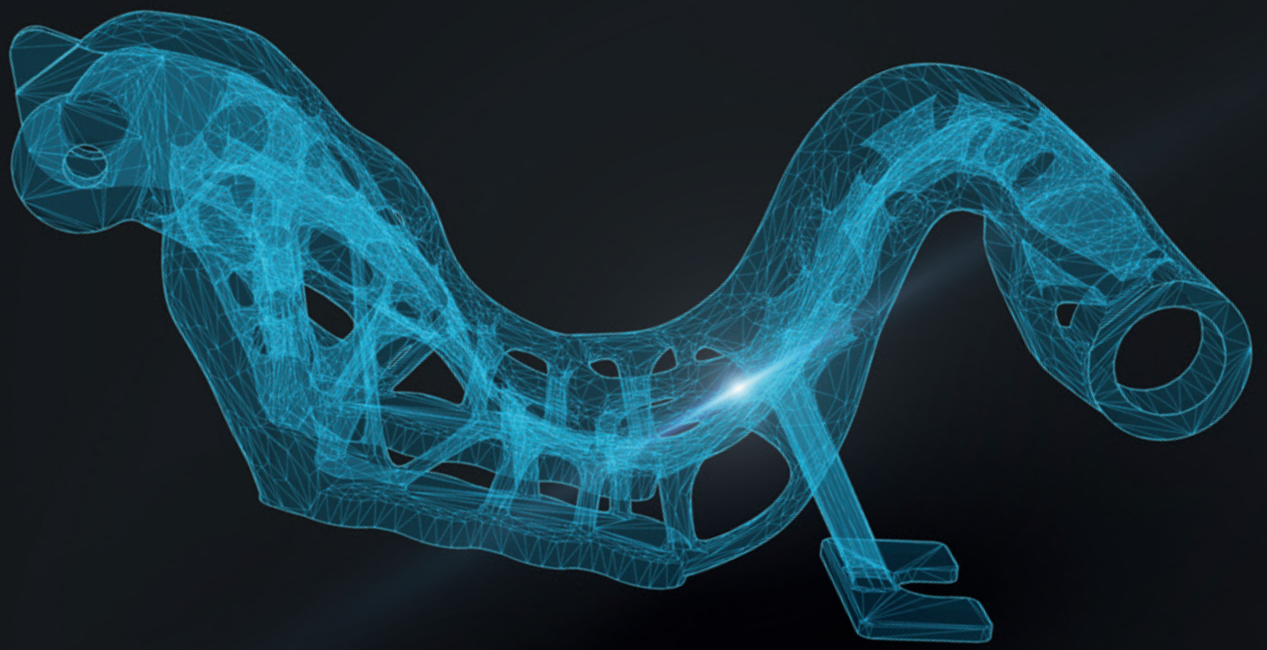


Designation:

GOOSENECK BRACKET

Industry:

AEROSPACE



Manufactured on:

SLM® 280 TWIN

Material:

Ti6Al4V

Joint optimization project

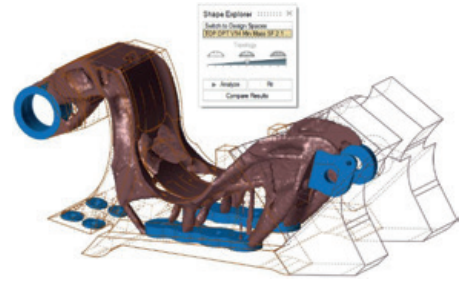
In the course of this optimization project ASCO and SLM Solutions have chosen a collaborative approach to achieve the best design of the new Gooseneck Bracket. SLM® application engineers were involved in the review of the different design steps to ensure manufacturability. The twin laser technology helped to reduce the build time from 82 hours down to 48 hours. SLM Solutions managed succesfully to set-up a process that handled the stresses and heat transfer inherent with large titanium parts.

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 Additive Manufacturing using 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 other parts were integrated. The optimized weight is 1416 g (versus 2050 g for the assembly) which means a reduction in weight of 31% and a reduction of the total assembly time.

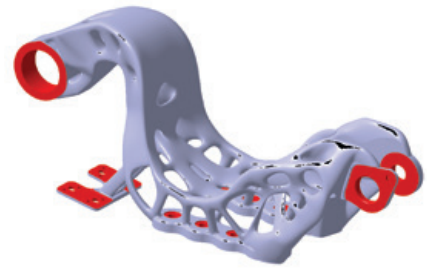
Improved buy-to-fly ratio

The buy-to-fly ratio of the machined version is around 17 while in the case of the SLM® version, the buy-to-fly ratio drops to 1.5 (accounting for the support structures to be removed and the small amount of extra material necessary for post-machining the interfaces with a close tolerance).



Reduced machining time

The machining time starting from a block was around 4.5 hours. In the case of the SLM® version, it is only necessary to machine the few interfaces highlighted in red in the picture on the right.



SUMMARY

Gooseneck Bracket

- World leader in the development of mechanisms for the actuation of slats and flaps
- Weight savings of 31% and reduction of the total assembly time
- Integration of three parts into one
- Buy-to-fly ratio reduced from 17 down to 1.5
- Significant reduction of machining time
- 42% reduction of build time down to 24 hours/part using a SLM®280 Twin (compared to single laser machines)

About SLM Solutions

The Lübeck-based SLM Solutions Group AG is a leading provider of metal-based additive manufacturing technology. SLM Solutions focuses on the development, assembly and sale of machines and integrated system solutions in the field of selective laser melting.

SLM® technology offers diverse options in the metal-based additive manufacturing of parts, such as a new design and geometric freedom, lightweight construction through the reduction of metal part weight, significant advantages in terms of production speed and the manufacturing of internal undercut parts in low quantities.

Our products are utilized globally by customers from the most varied sectors, particularly in the aerospace, automotive, tooling, energy and healthcare industries, as well as in research and education.

They particularly value the following advantages of our technology partnership:

- Highest **productivity** using patented multi-laser technology
- Highest material density and **part quality** through our innovative gas stream management
- Completely closed **powder management** in an inert gas atmosphere
- Cutting-edge process monitoring using various **quality control modules**
- Multilingual open **software architecture** with customer adaptability
- Ultracompact **modular design**
- Long-term and **confidential customer relationships**
- **A technological leader and pioneer** in metal-based additive manufacturing with decades of market experience

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SLM Solutions Group AG | Estlandring 4 | 23560 Lübeck | Germany
Phone +49 451 4060-3000 | Fax +49 451 4060-3250 | www.slm-solutions.com