Customer
KW Micro Power

Industry
Aerospace

Applications
Lightweighting
Heat exchangers

nTopology

KW Micro Power Creates Lightweight Multifunctional Microturbine Housing with Embedded Cooling Channels

KW Micro Power redesigned the housing of their aerospace-grade, compact turbogenerator for metal Additive Manufacturing. Using nTopology, they reduced its weight by 44% for a total savings of 4.5 kg.

This DfAM process opened new opportunities for KW Micro Power. The team converted the empty shell into a conformal cooling channel to improve the thermal management of their high power density generator.

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Lightweighting
44% decrease in mass

Function consolidation
3 functions in a single part

Maximum Temperature
33% decrease

Manufacturing process
LPBF with VELO3D Sapphire

Time to DfAM Redesign
Less than 1 day

Material
Aluminum F357

"I think this is like the renaissance of engineering. In the past, we were always working from the outside. Now, we can control every aspect of the geometry of our designs and their microstructure."

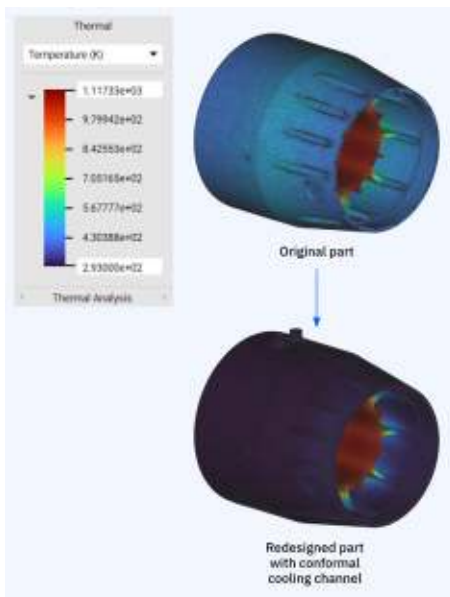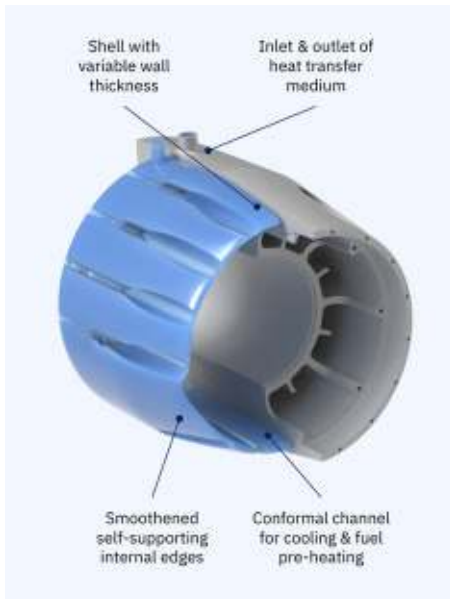**Enrique Enriquez, President of KW Micro Power**

Background

KW Micro Power designs and manufactures high power density Auxiliary Power Units (APUs) for commercial aviation and military applications. They are a small Florida-based manufacturer looking for new, cutting-edge solutions.

KW Micro Power offers a range of micro generator products, each optimized for a different use-case. For landbound applications, weight is not a big concern. However, for APUs on board an aircraft or drone, lightweighting is a number one priority — and every gram counts.

> "This component is a testament to what can be achieved by aggressive engineering companies that leverage next-generation design and manufacturing tools."

Zachary Murphree, VP of Sales at VELO3D

Shell with variable wall thickness

Inlet & outlet of heat transfer medium

Smoothened self-supporting internal edges

Conformal channel for cooling & fuel pre-heating

Lightweighting APUs for Aerospace

The engineering team managed to reduce the generator housing weight by 44% — *from approximately 10.4 kg down to 5.9 kg.* As a bonus, the original CNC machined housing can now be manufactured in a single piece with VELO3D's metal Additive Manufacturing.

To achieve this result, the team removed unnecessary material by creating a *hollow shell with a variable wall thickness*. The entire process required only a few simple design blocks in nTopology, was performed almost instantaneously without errors, and took less than a day's work before the part was ready to manufacture.

Cooling Electric Machines using Conformal Channels

KW Micro Power seized the opportunity to incorporate multiple functions into the same component. *The hollow structure that was initially conceived to reduce the motor casing's weight could also function as a cooling channel.*

The result was a 33% drop in maximum operating temperatures, while the external temperature of the generator dropped by 86% and down to 27°C, making it safe to the touch.

Fuel was used as the heat transfer medium, preheating it from room temperature to 55°C and increasing the efficiency of the combustion process.

Business Value

Innovation for SMBs
Develop new ways to design new products to gain a competitive advantage and stay at the forefront of your industry.

Open new markets
Modify your existing product line to serve the needs of different industries or use cases.

Highest-performing products
Take advantage of advanced engineering design tools to provide more value to your customers.

Technical Takeaways

Variable shelling
Leverage variable shelling to remove material from non-load-bearing areas of the part for significant lightweighting gains.

Automated smoothening
Smoothen conformal cooling channels to maximize cooling flow and create self-supporting internal features.

Conformal cooling
Use fuel as the heat transfer medium to further improve efficiency and take advantage of available resources.

Thermal

Temperature (K)

Thermal Analysis

Original part

Redesigned part with conformal cooling channel

About nTopology

nTopology was founded in 2015 to enable engineers and designers to create any geometry, no matter how complex, and meet the engineering requirements of high-performance products. Our software is used from research through production to create breakthrough processes and products for the aerospace, automotive, medical, and consumer industries. Our customers depend on nTopology's generative design capabilities to take full advantage of new hardware, optimize parts where performance is critical, overcome design bottlenecks, and augment their traditional CAD, simulation, and engineering software stack.

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