CASE STUDY

© SYNEX

FIGHTING FIRE WITH INNOVATION

ALTAIR® INSPIRE™ EMPOWERS M&H CNC TECHNIK TO OPTIMIZE SYNEX'S INNOVATIVE FIRE EXTINGUISHER

About the Customer

SYNEX TECH GmbH is a special machinery company based in Bad Goisern, Austria. With a focus on new machines, the company develops a variety of innovative products for customers worldwide. SYNEX's customers include companies specializing in wood-based materials, styrofoam, graphite, and carbon technology, as well as those in the automotive and metalworking industries. Developed from the idea of a mechanical engineering student who is also a firefighter, SYNEX developed DRILL-X, the world's first fire extinguishing device that combines drilling and extinguishing. Together with the additive manufacturing (AM) specialist M&H CNC Technik, SYNEX optimized the device's design and its manufacturing process.

Their Challenge

With DRILL-X, SYNEX developed a groundbreaking extinguishing tool that enables fire departments to extinguish fires that are difficult to access without placing fire crews at significant risk. Some of DRILL-X's key components include the guide vane, which generates the hydraulic momentum for the turbine; the drill shaft, located at the tip of the extinguishing lance connecting the drilling head, which enables firefighters to cut a hole into any surface; and a carrier part, which connects the main components and all steering functions.

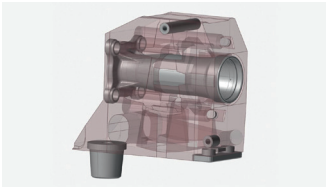
Although the carrier was designed to be printed from the start, it had a few flaws that made it difficult to 3D print. While 3D printing with powder bed fusion is one of the best ways to create lightweight structures, it often results in large printing volumes due to the necessary support structures. As a result, the material consumption for each print job is high, and the post-processing efforts to manually remove the support structures are immense.

PRINTING VOLUME REDUCED BY
45% ▼

PRINTING TIME REDUCED BY
35% ▼

POST-PROCESSING REDUCED BY
50% ▼

HYDRAULIC RESISTANCE LOSS REDUCED BY
270% ▼



LEFT: Inspire empowered SYNEX to achieve a carrier design that required far fewer support structures – reducing printing volume by 45% while lowering the post-manufacturing effort. **TOP:** Inspire helped the experts quickly define the design space and add all topology options to prepare the model for optimization. **BOTTOM:** Using Inspire, the team was able to define the component's ideal position on the building plate, which is important for the number of support structures and the overall design volume.

Images © M&H CNC Technik

To meet the manufacturing requirements and reduce material usage and the component's print time, SYNEX had to optimize the component for 3D printing. In addition, they sought to minimize the post-processing work while considering the component's high complexity, its multitude of requirements, and the need to make it as light as possible.

Our Solution

To tackle this challenge, SYNEX turned to M&H CNC Technik, who, together with Altair, began to optimize the component's topology using Altair® Inspire™. The goal for M&H was to reduce the number of support structures, which are both expensive to build and involve costly post-processing. Inspire helped the team's experts quickly define the design space and add all topology options, such as optimization objectives, stress and displacement constraints, acceleration, and gravity.

Most importantly, Inspire allowed M&H to consider manufacturing process constraints and restrictions, such as the 45-degree rule for metal AM. With Inspire, M&H was able to define the component's ideal position on the building plate, which is important for the number of support structures, the overall design volume, and downstream production steps. Taking into account the 45-degree rule, Inspire helped the team create a design where the majority of the struts were designed to have an angle larger than 45 degrees, thus reducing the amount of required support structures.

Results

In all, Inspire empowered SYNEX to achieve a carrier design that required far fewer support structures – reducing printing volume by 45%. Thanks to this reduction, SYNEX cut down both the printing time, and the support areas to manually post-process by more than 50%. This includes the ability to further process the component before removing the support structures, saving a lot of preparation time for the downstream milling of the part's different areas. The Altair optimization also improved the component's stiffness and made the design possible for serial manufacturing. Finally, SYNEX can now fully benefit from the advantages of additive manufacturing and was able to reduce hydraulic resistance loss by 270% compared to a conventionally manufactured carrier part.

"Altair Inspire, especially in combination with the selectable manufacturing restrictions, enables us to specifically design components for 3D printing and thus make optimal use of the advantages of additive manufacturing," said Philipp Schwemberger, head of additive manufacturing, M&H CNC Technik. In addition to optimizing components for the prototypes, Altair technology enabled SYNEX to optimize these parts with regard to series production, thus cutting down product development and AM costs by reducing material usage, print times, and post-processing effort.

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