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case study

AUTOMATED DEPOWDERING IN THE AEROSPACE SECTOR –

Thrust Combustion Chamber

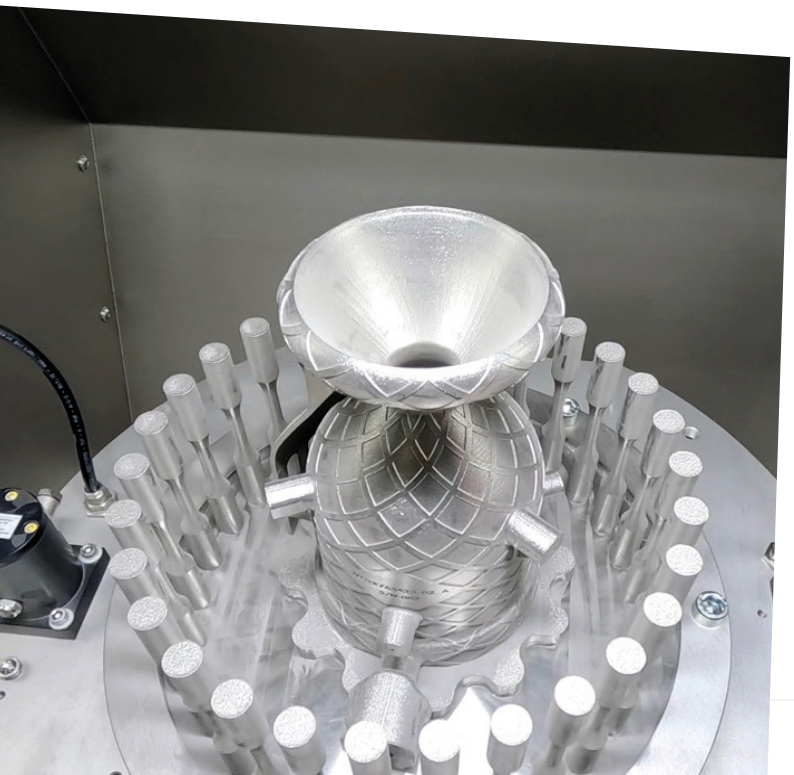
SOPHIA HIGH TECH

Introduction

The demand for automated depowdering solutions is particularly high for complex geometries, with a prime example being the aerospace sector. In this industry, parts often feature intricate internal structures, making thorough depowdering crucial. Companies in aerospace require full transparency, certification, and improved occupational health and safety, making automated depowdering a vital part of the production process.

A noteworthy case study is the depowdering of a Thrust Combustion Chamber manufactured by Sophia High Tech using the SLM [Selective Laser Melting] process with Inconel 718. Sophia developed and built a lightweight one-piece regeneratively-cooled thrust chamber assembly (TCA) for liquid rocket engines. Liquid rocket engines create thrust through the expansion of combusted propellants within the TCA.
The standard process for manufacturing thrust chamber assemblies (TCAs) involves separately constructing the injector, main combustion chamber, and nozzle, which are then connected using bolts or welds at the joints. Sophia's engineers are streamlining this process by eliminating complex joints and producing a single-piece TCA using advanced additive manufacturing technologies.

The depowdering process is essential to ensure that no powder residues are inside the TCA before being processed to the CNC Machining phase. The unique and advanced Solukon SPR® depowdering technology enhances operational efficiency and safety during the manufacturing process.



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SFM-AT350

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FACTS & FIGURES ABOUT THE APPLICATION AND DEPOWDERING PROCESS

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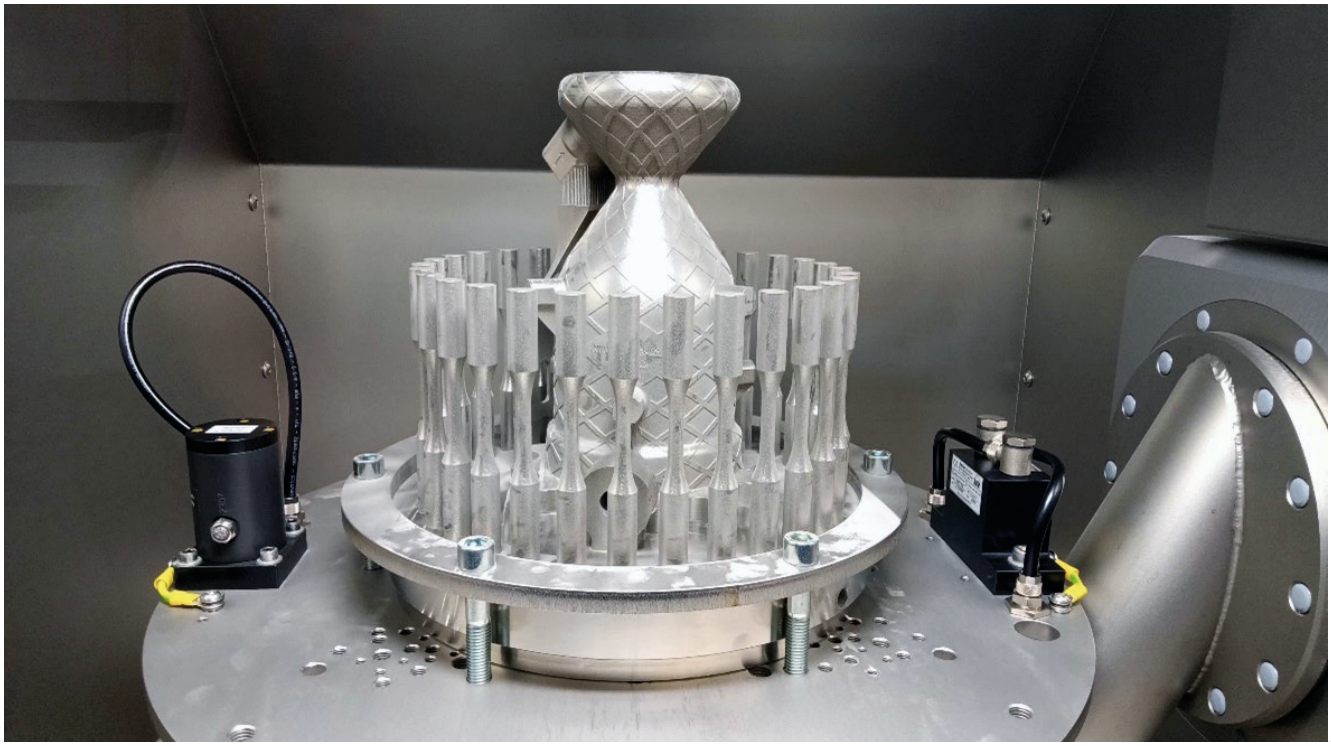
Build plate dimensions (B x T x H)	Ø 300 x 270 mm
Printer with which the part was manufactured	TRUMPF TruPrint 3000
Material	Inconel 718
Application	Thrust Combustion Chamber (Aerospace)
Structure / surface	1 Complex internal channels with rectangular sections (1 mm height, 3-5 mm length, total channel length of 500 mm)
Duration of automatic depowdering	40 minutes per cycle (2 Solukon Pathfinder cycles with 216 steps)
Depowdering system	Solukon SFM-AT350 with a high-frequency knocker
Mode used	Intel mode



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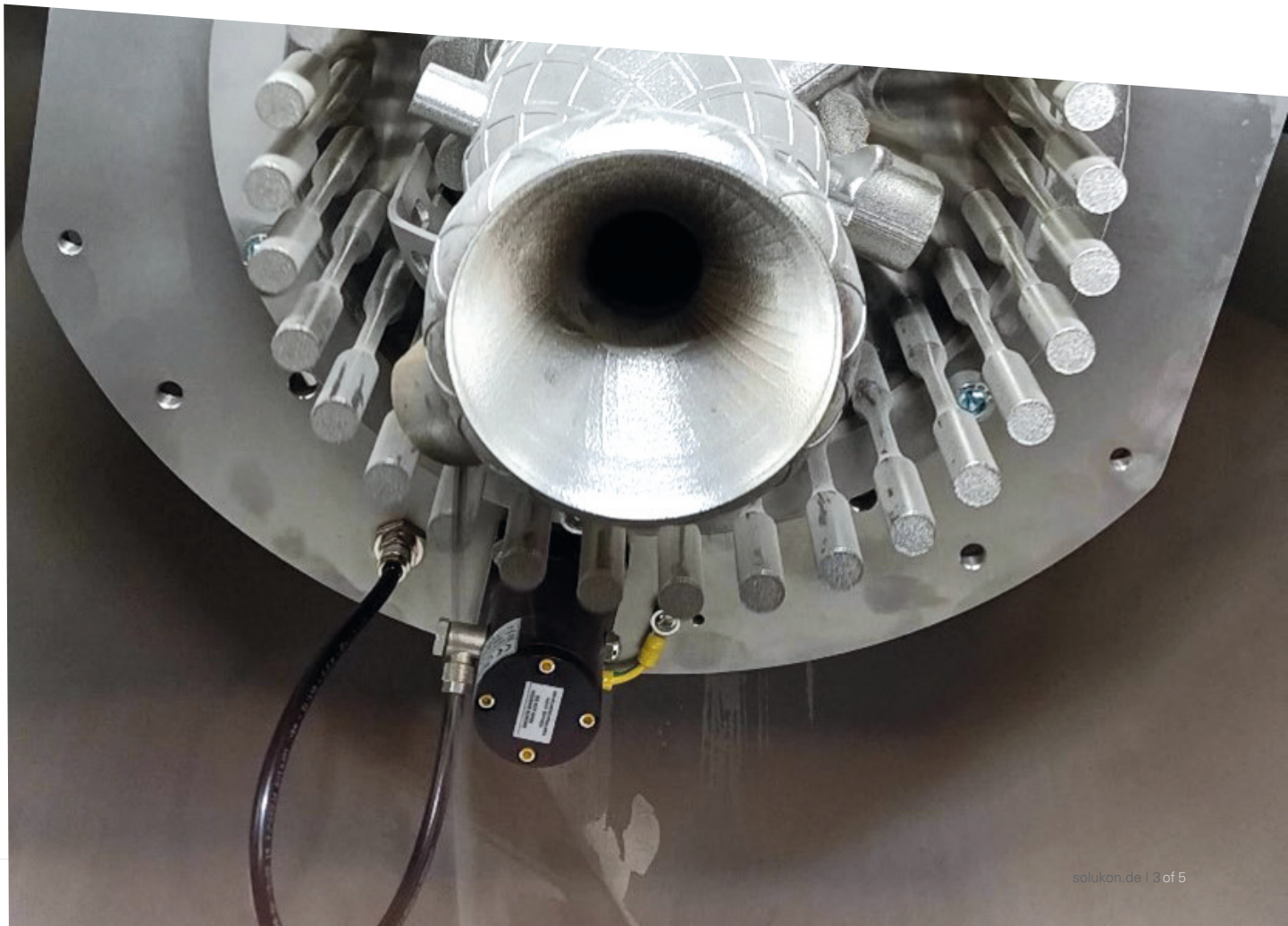
The depowdering process for Aerospace Parts at Sophia High Tech

After the 3D printing by SLM Process, the Solukon system removes the powder efficiently, while the part is securely held in place on the build plate. The system operates within an inert environment to ensure safety: the optimized chamber rapidly fills with protective gas, enabling the depowdering process to begin. Using the intelligent mode powered by SPR-Pathfinder software, the depowdering process is highly efficient.
SPR-Pathfinder requires only the part's CAD file to calculate the optimal motion sequence for the Solukon system, eliminating the need for manual programming. During the automated cleaning process, systematic vibrations facilitate the flow of powder from complex geometries, including the intricate channels of the combustion chamber. The SFM-AT350's integrated high-frequency knocker efficiently removes any residual powder or powder cloggs, achieving thorough depowdering in approximately 40 minutes.



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Safety and Efficiency

The automated depowdering process significantly enhances safety for operators, as all operations can be performed within a sealed process chamber under inert condition,minimizing exposure to metallic powders. A thorough cleaning of the system is necessary to prevent cross-contamination, particularly when recycling recovered powders.

Why is Solukon the right partner for depowdering?

Solukon technology plays a crucial role in improving occupational health and safety at Sophia High Tech. By automating the depowdering process, the risk of operator exposure to residual powders is significantly reduced. Operators appreciate the efficiency and reliability of the SFM-AT350, which simplifies the cleaning process and provides a more consistent outcome compared to manual methods.

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„The automated system has drastically improved our workflow. It's efficient, safe, and the results are always consistent, which is something we couldn't achieve manually. With SPR-Pathfinder® we don't even need to do any programming for the machine anymore. It's a very smooth depowdering workflow with a reliable cleaning quality."

says
Dr. Giovanni Caferra,
one of the lead operators at Sophia High Tech.

Overall, the SFM-AT350 is low-maintenance and of ultra-high quality, making it a highly recommended choice for other additive manufacturers in the aerospace sector.

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About Solukon

Solukon Maschinenbau GmbH is a German high-quality supplier of powder removal and processing systems for metal and polymer additive manufacturing. In 2015, Solukon presented the world's first system for automated depowdering. Founded by Andreas Hartmann and Dominik Schmid, the Augsburg-based company has extensive experience in the development of AM systems and related peripheral equipment, and offers a full range of industrial powder processing systems.

Since 2022, Solukon has also been offering the world's first and unique intelligent software for automated simulation and (pre-)calculation of the depowdering of laser-melted metal parts, the SPRPathfinder®.

Solukon products meet the highest functionality and safety standards and are approved for safe and reliable removal of tough-to-handle and reactive materials such as titanium and aluminum. Solukon has established itself as the market leader in the field of industrial powder removal with its powder removal systems for metal.

About Sòphia High Tech

SÒPHIA HIGH TECH, certified according to the Aerospace Quality Standard AS/EN9100, was born from the deep-vocation for product development. SÒPHIA operates in the Aerospace & Defense field, extremely focused on the design, development and manufacturing of metal alloy parts using Additive Manufacturing (3D Printing) and CNC Machining. The company is located in Somma Vesuviana, Italy.

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