



The Stratasys Neo450s at Mackart Additives facility maximizes their in-house AM solutions capabilities and product development solutions

Silverstone Composites and Mackart Additive Drive Innovation to Create Unique Solutions Using Stratasys Stereolithography Technology

Executive Summary:

UK-based Silverstone Composites Ltd, provides bespoke composite manufacturing solutions to a variety of trade sectors including aerospace, automotive, marine, medical mobility, military and track bikes industries. To keep up with customer demand within motorsport and Formula One, the team needed to develop a method to produce composite pipes – for which an internal mandrel tool is essential. As such, fellow Silverstone Technology Cluster member, Mackart Additive, was approached and challenged to create a unique resolution to match this requirement. Using its Stratasys Neo450s 3D printer and the Somos® DMX SL-100 stereolithography material, Mackart Additive utilized its experience and industry expertise to develop an additive manufacturing method of part production for the internal mandrel – the only solution available of its kind in the UK from a supply point of view.



“

Stratasys Stereolithography (SL) has enabled us to find a niche in our market, helping us to evolve as we offer a unique method of additive manufactured mandrel tooling. Our customer came to us with a problem and there was no alternative solution.”

Marcus Trofimov

Founder and Managing Director,
Silverstone Composites Ltd.



Elements of the internal mandrels such as the composite material being easily wrapped around the mandrel and then extracted just isn't possible using traditional tooling methods

Challenges:

- No alternative solution for mandrel tooling for a composite pipe had been previously implemented
- Production of mandrel tooling using traditional methods such as aluminum was not viable as it could not be extracted from the composite pipe
- Previous to using SL technology, each mandrel tool could take up to one-hour of post-processing per tool and human-error can often happen as a result

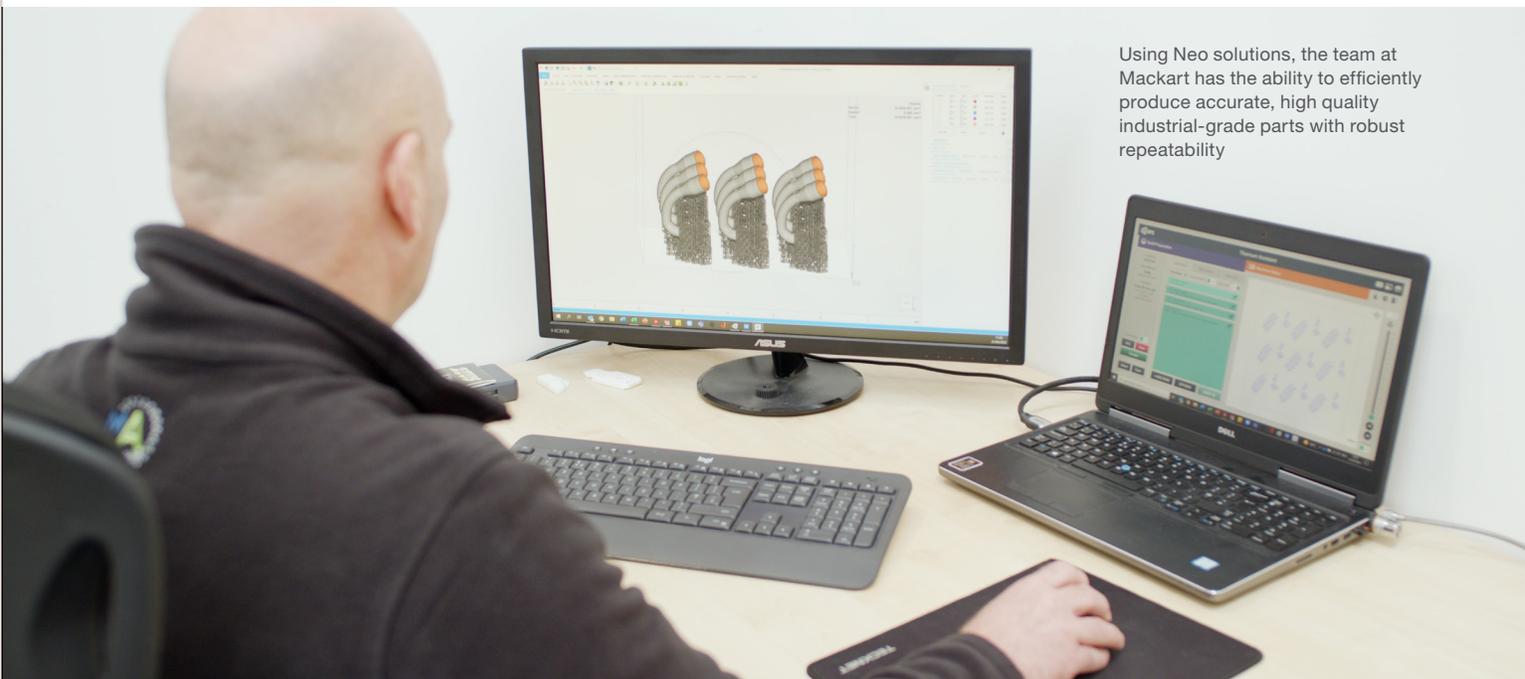
Values:

- Having switched from other SL 3D printing methods, the surface finish of the mandrels produced using the Neo450s greatly reduces the post-processing time and almost completely minimizes the need for manual-labor and handling of the parts – saving up to one-hour per tool
- Use of Somos® DMX SL-100 stereolithography material meets the internal mandrels' strict requirements in terms of the amount of pressure and temperature they can manage
- The internal mandrels produced on the Neo450s are easily extracted from the composite pipe, not previously possible using traditional manufacturing methods

Located in the heartland of British motor racing and Formula One, [Silverstone Composites Ltd](#), is a solutions provider with industry expertise in the design and manufacture of carbon fiber, covering the whole manufacturing process from design to the production of composite components and parts. In keeping with its surroundings, the company primarily operates in the motorsport sector.

Silverstone Composites Ltd is a member of [The Silverstone Technology Cluster \(STC\)](#), an organization aimed at pooling the knowledge of advanced engineering, electronics and software businesses in the wider geographical area surrounding Silverstone. It is within the STC that a partnership began with fellow members Mackart Additive; a mechanical engineering business with expertise in Designing for Additive Manufacture (DfAM), maximizing their in-house additive manufacturing (AM) capability, providing product development and production solutions.

The partnership has grown over the course of three years and benefits from a shared technological and industry expertise. As the collaboration developed, both companies researched and implemented new methods of exponentially increasing the service offering they could provide customers – a key driver in Mackart's purchase of the Stratasys Neo450s 3D printer in October 2021.



Using Neo solutions, the team at Mackart has the ability to efficiently produce accurate, high quality industrial-grade parts with robust repeatability



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According to Steven McCarthy, Founding Director and Principal Technical Engineer, Mackart Additive, it is specific customer demands that led to the investment in the Neo450s 3D printer: “We have had significant experience with a number of AM technologies since our inception as a company. As customers started to demand bigger parts with more complex geometries, we had to expand our offering, so in collaboration with the Silverstone Composites team last year we identified Stratasys’ Neo solutions as the next step in our growth. The ability to efficiently produce accurate, high quality industrial-grade parts with robust repeatability directly answers the increasingly exacting demands of our customers and helps our business and that of Silverstone Composites evolve and develop new and exciting solutions.”

As an open resin system, the Neo range of 3D printers provide materials with a wide array of properties to suit customers’ specific application requirements - be it chemical resistance, heat tolerance, flexibility, durability, and optical clarity – particularly useful in high intensity sectors such as motorsport. They feature dynamic laser beam technology that enables improved build accuracy, increased feature detail, and low variability across the full extent of a large build platform. The Neo450s can produce complex industrial grade quality prototypes, tooling or master patterns and build parts with accurate detail and outstanding sidewall quality.

Creating a unique and repeatable solution

With a wide range of customers in different industries, Silverstone Composites must adapt to the often-meticulous demands that are required, specifically in Formula One. The team has to constantly find ways of evolving and differentiating itself from its competitors and even the Formula One teams, many of whom have AM facilities in-house.

In this regard, the team is often commissioned to fulfill projects in collaboration with Mackart Additive that are needed quickly, making traditional production and manufacturing methods a less viable option or maybe not an option at all.

According to Marcus Trofimov, Founder, Silverstone Composites Ltd., this is typified in one such project the team undertook for a Formula One customer. “In this instance, the customer urgently needed an internal mandrel tool to create a composite pipe and had no alternative solutions to hand. This provided both our companies the perfect opportunity to implement our knowledge and expertise into a use-case and corner a new area of the market,” he explains.

“The composite pipes used on vital components of cars such as break ducts or engines require a specific type of manufacturing method that retains good internal surface in order for the tool to be extracted from the pipe,” he adds. “Any mandrel tool produced using traditional methods would

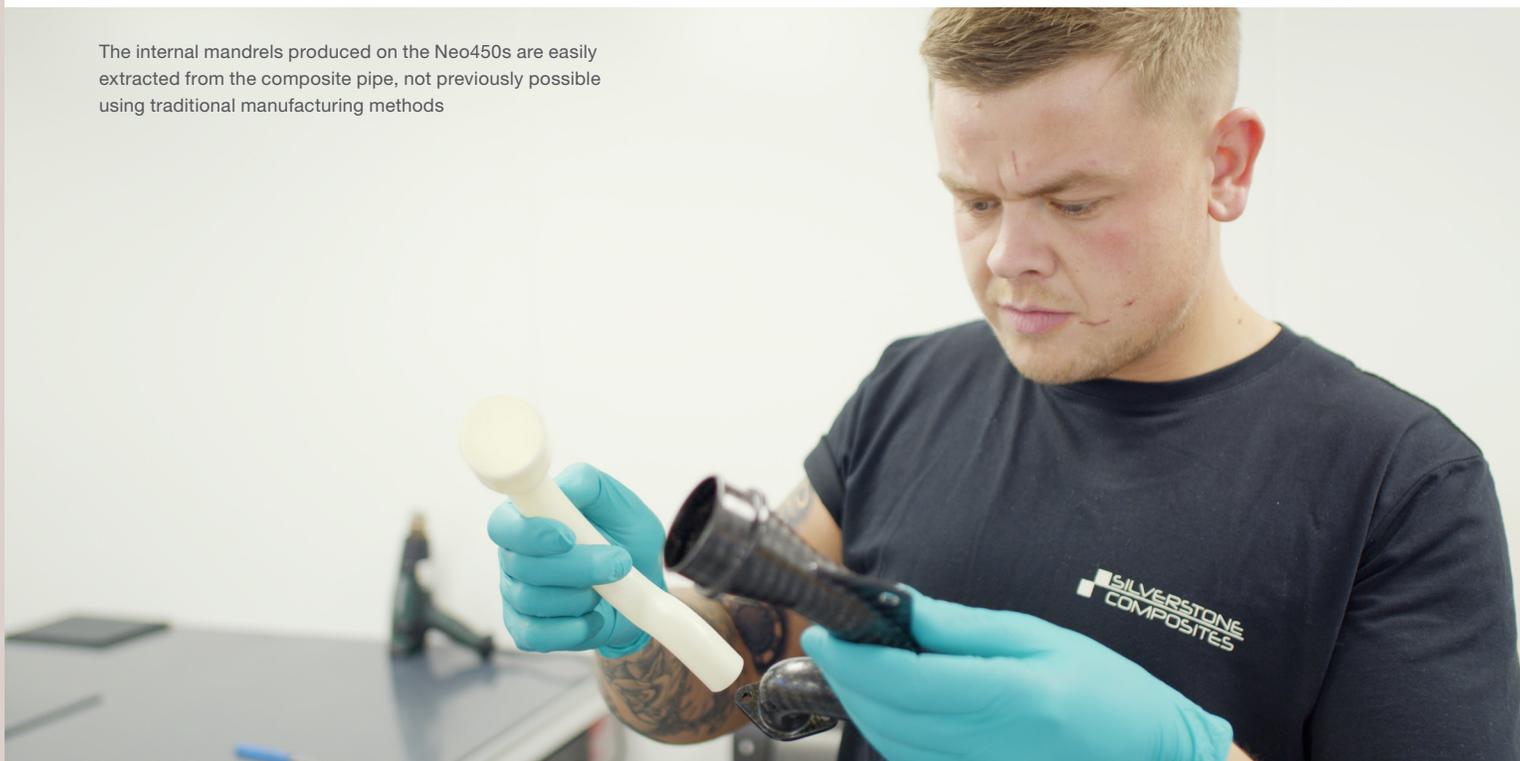
require a lot of post processing after the print and then once the part has been produced the extraction of the material needs to be dissolved in a solution. This can take days if not weeks to dissolve and is therefore unviable.”

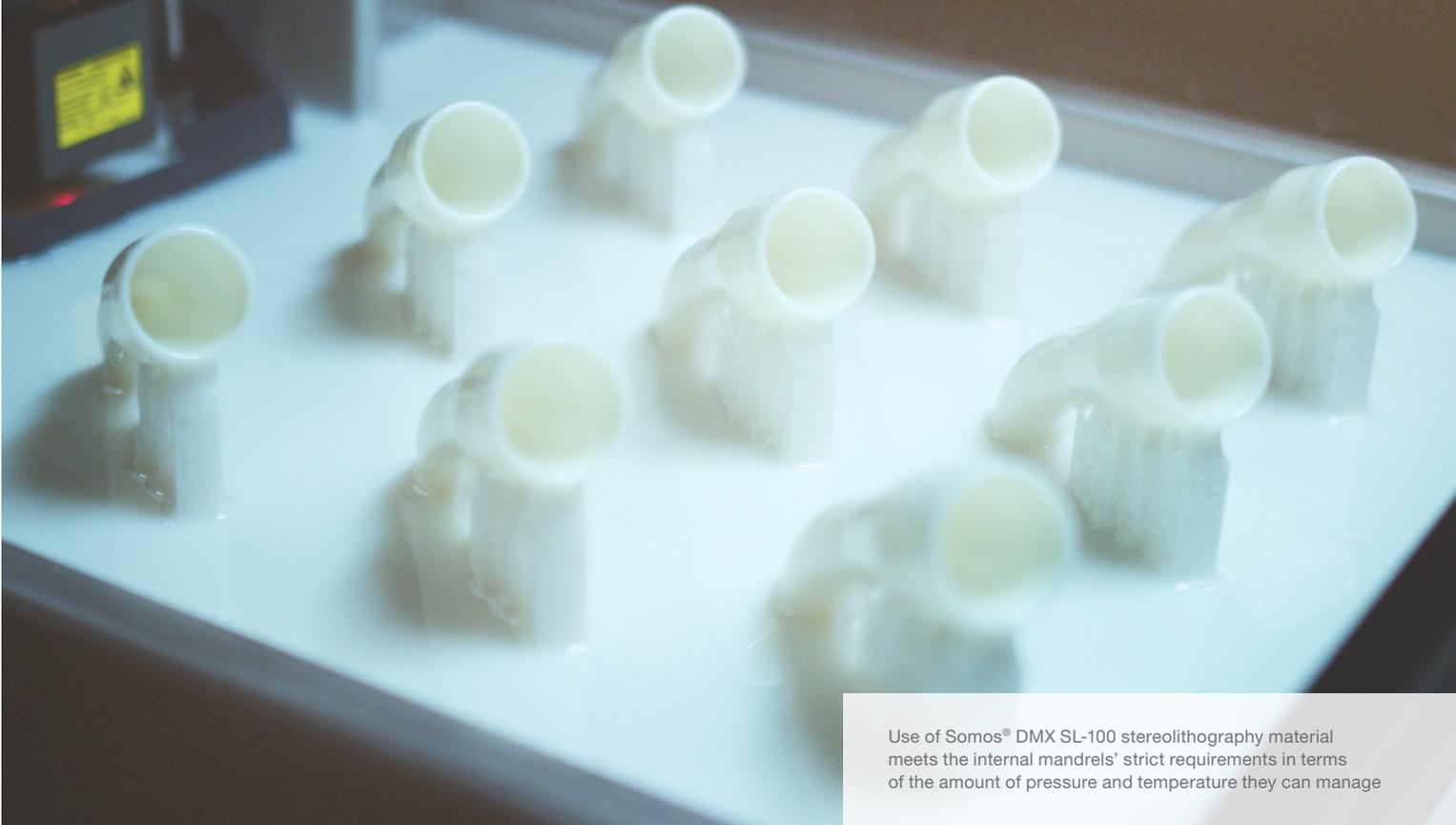
To further complicate the issue, each individual mandrel could take up to one-hour of manual post-processing time, inviting human-error and increased manual labor into the equation - particularly strenuous as around 15 kg’s worth of resin is used to produce the mandrels each week.

In contrast, the one-build platform capability of Mackart Additive’s in-house Neo450s streamlines the whole process as the part is almost ready to be sent-off to Silverstone Composites as soon as it leaves the 3D printer. As a result, the Formula One customer and other customers can request the parts on-demand.

Trofimov, continues, “We have to constantly adapt to our customers’ needs and come up with unique solutions to thrive as a business. The internal mandrels are a perfect example of that. Elements such as the composite material being easily wrapped around the mandrel and then extracted just isn’t possible using traditional tooling methods. The surface finish is so good that post-processing time is greatly reduced and there is no need for manual labor, other than lifting the mandrel out of the build tray and transporting it.”

The internal mandrels produced on the Neo450s are easily extracted from the composite pipe, not previously possible using traditional manufacturing methods





Use of Somos® DMX SL-100 stereolithography material meets the internal mandrels' strict requirements in terms of the amount of pressure and temperature they can manage

The right material at the right time

After taking on the project, the team at Mackart Additive made direct comparisons with other materials used previously on their other in-house 3D printers and identified the Somos® DMX-SL 100. It is a durable and tough stereolithography material that enables the production of complex, hollow composite parts in days thanks to a unique and cost-effective 'dry removal' process - and all with no compromise on quality and aesthetics.

The 'dry removal' process enables the mandrels to be removed from complex, convoluted geometries after the autoclave without the need for submersion in caustic (which can affect the composite part). Somos® DMX-SL 100 produces very accurate parts with a superb surface finish and outstanding feature detail that can withstand the extreme temperatures of the autoclave process utilized in composites manufacturing, maintaining its flexural strength, elongation and tear resistance.

Trofimov continues, "The composite parts produced using DMX-SL 100 have the best overall tolerance to temperature and pressure that I have seen for the mandrel application, which has strict requirements in both cases. The mandrel also needs to be sealable and releasable so it

can be extracted from the composite part. We approached Mackart Additive with these material challenges and were blown away with the results."

Continuing to evolve and meet demand

Both companies have stated they will look to push the boundaries of the technology further as customers demand continues to increase, which is a certainty as the demand is reportedly already there.

McCarthy states, "The journey we have been on so far has been incredible and this is just the start of our lifecycle using the Neo solutions. It is natural for us to be thinking about further investment as we create new opportunities for both our companies. Having the 3D printer in-house and the help and support of Stratasys increases our chances of evolving even further as a business."

This sentiment is echoed by Trofimov, as he concludes, "The aim is to explore in collaboration with Mackart Additive new tooling applications as well as potentially end-use parts. Our customers have seen the benefits of the technology and the demand is increasing."



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