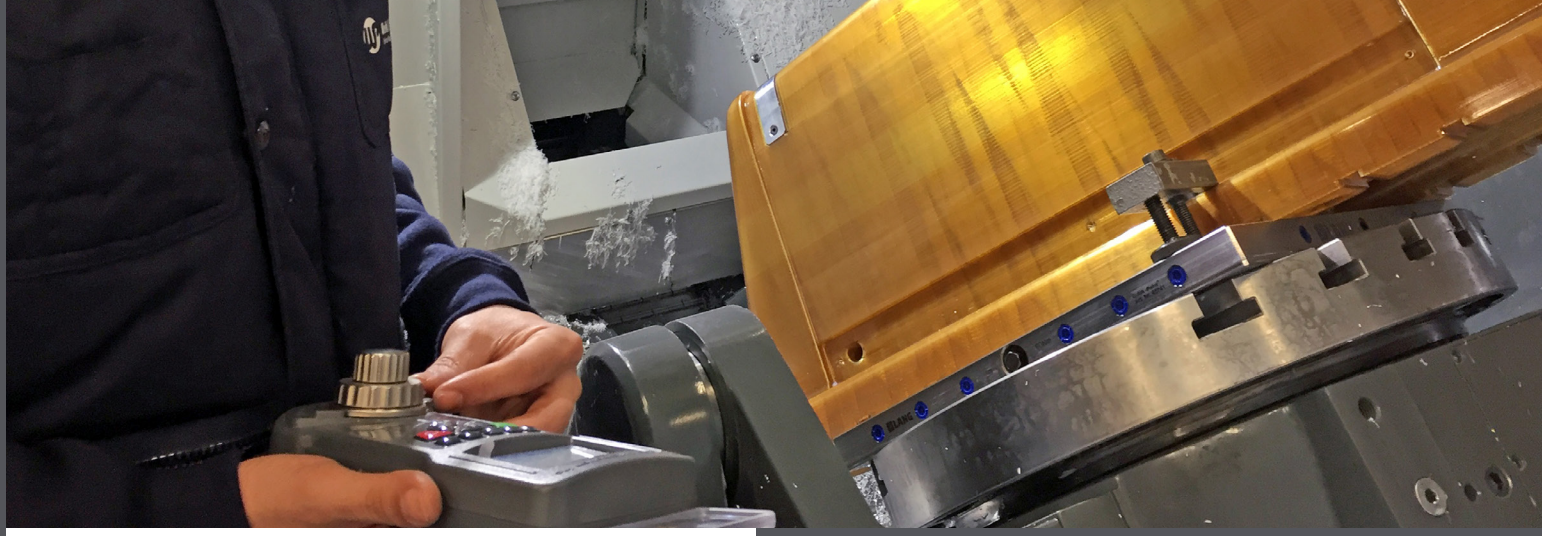


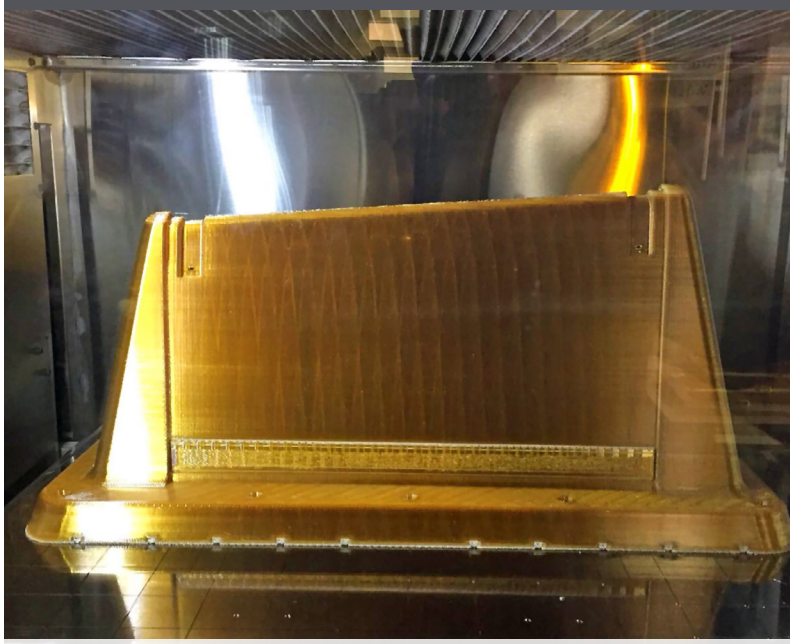
IDEC and Wehl & Partner Reinvent Composite Molding With FDM Additive Manufacturing

IDEC is a leading Spanish provider of composite solutions for the aerospace industry, servicing its customers' design and manufacturing needs. With the help of advanced manufacturing service bureau, Wehl & Partner, the company embarked on a project to increase its competitiveness by reducing the time, cost and material waste of traditional composite molding.

The project focused on exploring the capabilities of resin transfer molding (RTM) technology for testing new composite material and the molding process to manufacture a curved aircraft wing.

> "Not only did the use of additive manufacturing slash the production lead-time on the preform tool, but we also expedited the whole traditional composite molding process."

Diego Calderón
Structural Analysis Manager, IDEC



The preform tool produced with the Stratasys F900 Production System using ULTEM™ 1010 resin.

stratasys

Case Study

The preform tool offered perfect mechanical properties to resist high temperatures, enabling the team to reduce the carbon fiber heating stage from one hour to ten minutes.

An Unusual Challenge

Feasibility tests took place throughout the process to assess how production could be accelerated, starting with the manufacture of a conventional preform tool. Designed to facilitate the composite lay-up process, the preform tool is typically made of metal, such as aluminum, or an epoxy resin. The composite fiber is laid up on top of the preform and the tool is heated to take the shape of the mold.

The challenge in this case was the heating aspect of the process, which required heating the composite material instead of the preform tool using an electric current. Highly conductive metals like aluminum were inappropriate, preventing the current from effectively going through the composite fabric. Standard epoxy materials available inside the company also presented an issue, as they were neither resistant nor stable enough to withstand temperatures exceeding 140 °C. This project required high temperatures of between 150 °C and 180 °C to heat the fabrics directly.

Overcoming the Limitations of Metals and Epoxy

The engineering team quickly realized that this process was not achievable with conventional manufacturing methods and consulted advanced prototyping service provider, Wehl & Partner, for advice. The Navarra-based company offers a wide range of solutions from conventional machining to additive manufacturing technologies.

With Wehl & Partner's help, IDEC found an alternative solution in FDM® additive manufacturing, which enabled them to test the suitability of the RTM process in conjunction with the aircraft wing project. ULTEM™ 1010 resin was chosen to produce the preform tool. The material's excellent chemical and high heat-resistance enables it to withstand temperatures exceeding 150 °C.

"We couldn't have done this with a conventional epoxy resin, which would have become unstable or even break beyond temperatures exceeding 140° C," explained Diego Calderón, Structural Analysis Manager at IDEC. "Although there are epoxy resins resistant to such high temperatures, these are very expensive, and they would not have been financially viable for our project."

The ability of ULTEM™ 1010 resin to withstand the required temperatures and pressures simplified the preform production process. According to Calderón, the preform is so solid that the team can use it for at least 25 cycles, something simply not possible with epoxy or other additive manufacturing technologies and similar materials.

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The material was also an excellent option to replace metals, thanks to its superior tensile strength and non-conductive properties, vital for the electrical heating application. The result offered a smooth surface finish, enabling optimal adherence with the carbon fiber material and a perfect molding.

Cutting Production Lead Times

Using a Stratasys F900 acquired through local partner, Pixel Sistemas, Wehl & Partner was able to manufacture a large-scale preform tool using the system's large build tray. The tool was produced in just 60 hours – significantly less time than if the team had selected a more traditional method of manufacture.

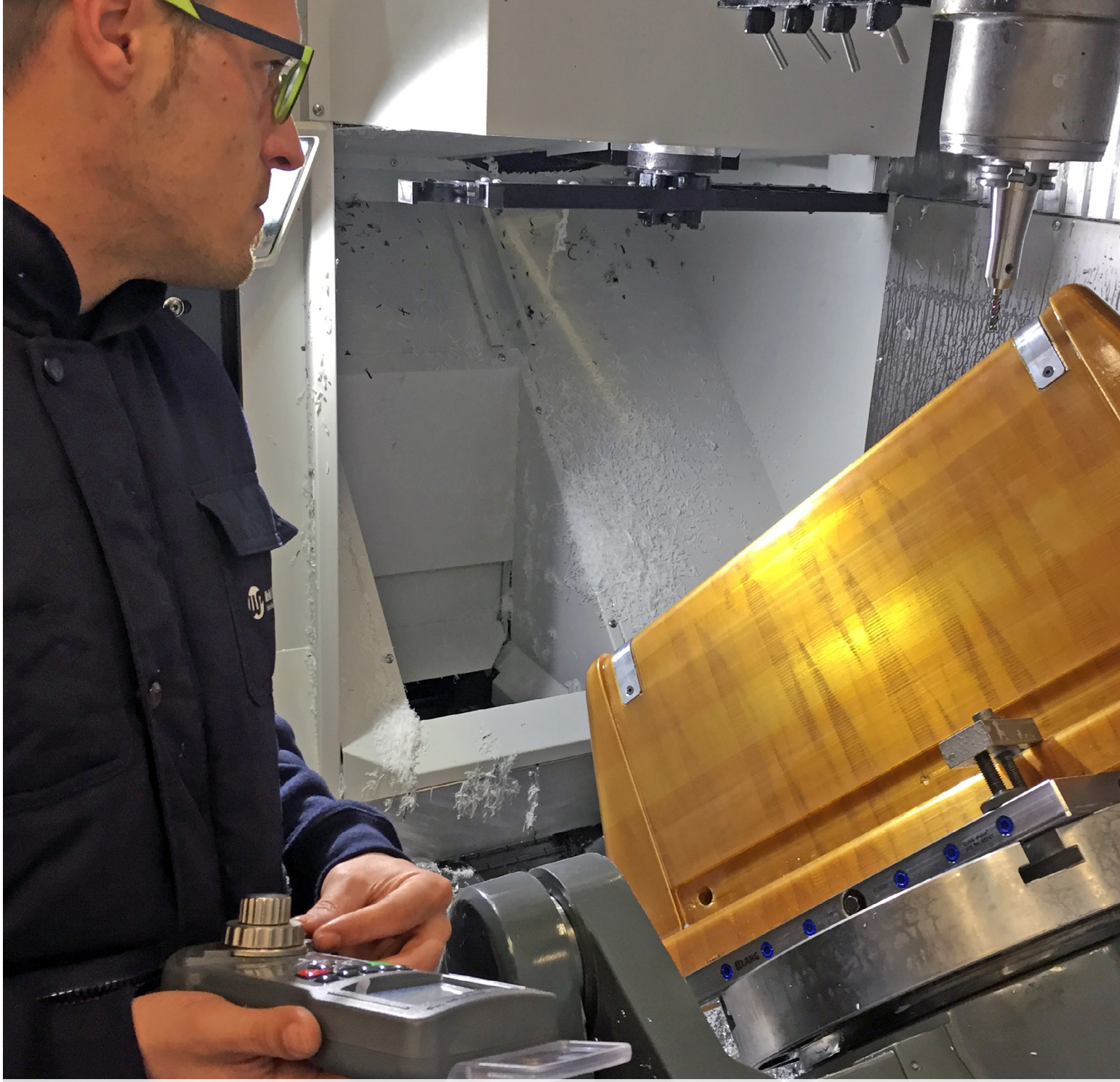
"With CNC machining, it would have taken us at least four weeks to produce this type of part," affirms Javier García, Director of Wehl & Partner. "Not only did the use of additive manufacturing slash the production lead-time on the preform tool, but we also expedited the whole composite molding process."

"With the use of ULTEM™ 1010 resin, we've obtained a preform tool with perfect mechanical properties and have been able to deploy this innovative step in the RTM process. This has seen us reduce the composite heating stage from one hour to only ten minutes by flowing the electrical current directly through composite fabrics," he continued. "This would not have been possible without FDM additive manufacturing."

The team has also been able to save up to 67% of the costs of CNC machining aluminum, a technical innovation which met the initial objective to reduce manufacturing costs.

The final composite part of a curved aircraft wing, produced with FDM technology.

The solution provided by Wehl & Partner has contributed to IDEC's competitive RTM innovation. It also demonstrates the many possibilities FDM additive manufacturing offers composite molding applications, while adhering to the rigorous technical requirements of the aerospace industry.



The robustness of the ULTEM™ 1010 resin simplifies the preform production process and enables the team to use it for at least 25 cycles.

Stratasys Headquarters

7665 Commerce Way,
Eden Prairie, MN 55344
+1 800 801 6491 (US Toll Free)
+1 952 937-3000 (Intl)
+1 952 937-0070 (Fax)

1 Holtzman St., Science Park,
PO Box 2496
Rehovot 76124, Israel
+972 74 745 4000
+972 74 745 5000 (Fax)

stratasys.com
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