

# NEXT GENERATION SANDWICH PANELS

Comprehensive research and technology enables new kind of sandwich panel manufacturing

**With a combination of six new technologies the Composites Manufacturing Lab (CML) at the GE Global Research facility in Munich proves a novel concept for the manufacturing of sandwich panels. The process involves forming of dry fiber Automated Fiber Placement (AFP) as well as stitched foam cores and Fiber Patch Preforming.**

The use of sandwich panels is very common, especially in the wing section of aircraft. Currently, GE Aviation at Hamble (UK) manufactures aircraft sandwich panels with prepreg fabric material and honeycomb cores. Those panels consist of four independent parts: core, under-core plies, so-called picture-frame plies and over-core plies. In the 'Next Generation Sandwich Project' the CML in Munich is supporting GE Aviation to automate sandwich panel manufacturing by investigating potential novel technologies:

1. The new core material used is Tied Foam Core developed and manufactured by the Airbus Group. This core uses a standard Rohacell foam material that gets stitched with undrilled rovings to adjust mechanical properties.
2. Both under-core and over-core plies have been prepared as flat stacks made with dry fiber AFP. Thereby, the process leverages the advantages of the technology: high accuracy and layup speed, low waste, short process times

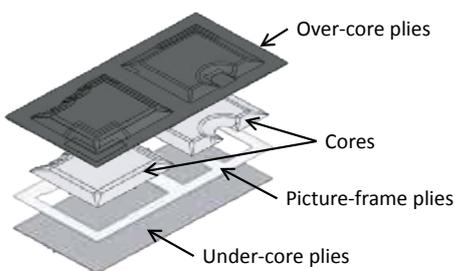
and the opportunity of forming flat parts in a second process step. Those flat stacks have been manufactured by the Fraunhofer Institute in Augsburg.

3. For the picture-frame plies, Fiber Patch Preforming (FPP) is used as the process is not limited by a minimum cutting length. The FPP layups have been prepared at the Technical University of Munich (TUM) in cooperation with the LCC (Lehrstuhl für Carbon Composites) as well as the company Cevotec.
4. The over-core plies are brought to their final three-dimensional shape by a thermoforming process that has been developed in cooperation with Coriolis Composites. All trials have been conducted on equipment which involves an IR-heating field and uses a metal die forming tool that has been developed at GE. The development of the panel thermoforming has been carried out within a master's thesis by Anja Nieratschker and has been awarded the CCeV study prize 2016 in the category Best Master's Thesis.

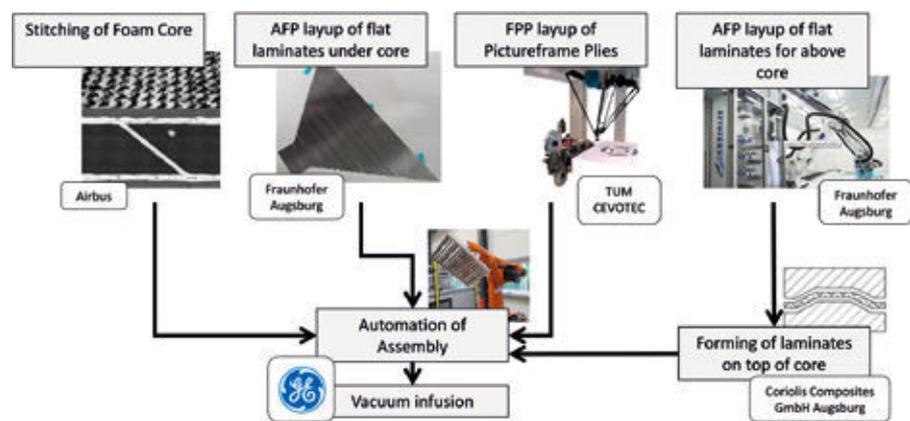
5. To minimize manual labor in the process all parts are assembled automatically before infusion. This part of the project has been done on a conceptual basis by GE. The concept for the automated assembly involves automated positioning of all parts, as well as the application of auxiliary material and infusion of the panel.

6. The infusions of the assembled panels have been done with a Vacuum Assisted Resin Infusion process (VARI) to utilize the flexibility of the process and save tooling cost. All infusions have been done internally at the Composites Manufacturing Lab at GE Global Research in Munich.

These six novel technologies have been investigated at a representative generic sandwich geometry provided by GE Hamble. This generic geometry involves characteristic features of different typical aircraft fixed trailing edge wing panels and is thereby well suited to show the feasibility of the process. Starting on a subscale le-



Setup of the investigated sandwich panels



Overview of novel manufacturing process developed at the Composites Manufacturing Lab of GE's Global Research Center in Munich

vel, further development led to full-scale trials and finally two full-scale demonstrators have been manufactured. A proof of concept has been demonstrated and follow-up projects are already discussed with GE Aviation.

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*Anja Nieratschker (left) was honoured for her excellent Masters thesis. The laudation was held by Dr. Tilo Hauke (right), head of company research at SGL Carbon and member of the board of CCeV.*

The Next Generation Sandwich Project is an interdisciplinary research project led by GE in cooperation with the TUM, Cevotec, Airbus, Coriolis Composites and the Fraunhofer Institute in Augsburg.