3D-woven composite materials: the Jacquard loom 2.0

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Behind a state-of-the-art technology

My buddies said to me: “Patrick, since you’re going to Lyon for the Festival of Lights, you’ve got to visit the Maison des Canuts, a museum that...”

Now that fascinated me, because I’m an engineer at the Safran Aéro Composite plant in Commercy (Lorraine region of France). We use an early programming system based on perforated cards to create very sophisticated patterns. As the guide told us, “Some historians believe that this model is in fact the ancestor of today’s computers and robots.” At this point, I whispered to Paul: “You see, it’s like the work I do. We also use the weaving technique to make parts for the new LEAP engine.” With that, my son seemed to take a new interest in me. After a short pause, he asked, “So what did you guys invent?”

Safran quite simply applied the principle of this amazing machine that’s in front of your eyes. In a way, this old loom-inspired the weaving technique we use today to make composite engine parts using this patented 3D weaving technology, invented by a Safran engineer.

The only manufacturing process of its kind in the world

After describing the technical improvements in these looms over the years, the guide invited us to see a demonstration. The 3D-woven composite technology has revolutionized the industry, reducing material waste by 20%, improving fatigue life by 35%, and... 7 km of fibers are required to make a single fan blade. The threads that are constantly interwoven remind me of our own 3D-woven RTM (resin transfer molding) composite process, which allows us to move from the original design of the preform to the start of weaving, compared with several months using previous manual methods.

New applications on the horizon

Composite materials represent a sea change in the aerospace industry. Their combination of strength and lightness makes a significant impact on the design of new aircraft. We’re exploring new applications for composite materials, particularly in the use of these materials to aircraft engine parts subject to greater mechanical or thermal stress, such as compressors.

Back in the museum gift shop, I ask my son, “Hey Paul, how would you like to visit my factory and see how we do things?”

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