3D-woven composite materials: the Jacquard loom 2.0

The 3D-woven composite technology designed and developed by Safran enables us to make stronger and lighter parts. This is a major innovation, and plays a key role in improving the performance of the new LEAP commercial airplane engine, which consumes 15% less fuel than its predecessor.
Safran is a leading international high-technology group with three core businesses: Aerospace, Defence and Security (ongoing R&D). It is a key player in the world of aviation and a major player in the fields of propulsion, aeronautics, defence and security, industrial technologies and digital solutions.

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The 3D-woven composite technology designed and developed by Safran enables us to make stronger and lighter parts. This is important when developing civil engines, such as the Leap engine manufactured by LEARJSN. This is a major milestone for Safran, which is also improving the performance of the new LEAP commercial airplane engine, which consumes 15% less fuel than its predecessor.

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 is an interesting place to visit for an engineer. It is one of the best museums of textile history in the French county of Lyon. It contains one of the finest collections of Jacquard looms. It was invented by Joseph-Marie Jacquard in 1801. It could be operated by a single worker – an industrial revolution at the time!

Now that fascinated me, because I'm an engineer at the Safran Aéro Composite plant in Commercy (Lorraine region of France), which designs and manufactures composite parts for aircraft. I work on parts that are made using the resin transfer molding (RTM) process, carrying on this centuries-old craft of weaving, but with a modern twist.

So before attending the magical light show, I took my son Paul, who's 12, to visit the museum, in the Croix-Rousse. It is located in the heart of the city, which was once the most important weaving centre in the world. We visited the 19th century Jacquard loom that could be operated by a single worker. 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?"

It's hard to answer that in just a few words, but I tried.

Safran quite simply applied the principle of this amazing machine that's in front of your eyes. In a way, this old loom is the ancestor of the machinery 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. "These new parts provide significant weight savings, which means lower fuel consumption and fewer oxides of nitrogen."

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 parts. They require much less time to manufacture, reducing the time 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 big difference when it comes to replacing metal parts, reducing the weight of the aircraft. We are now using 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?"

Enjoyed this story, the technology invented and developed by Safran enables us to make stronger and lighter parts.