The open rotor, the engine of tomorrow on the test bench

The “open rotor” is a future-generation aircraft engine developed by Safran. It leverages its revolutionary architecture to deliver ACARE\(^\text{1}\) fuel-consumption and CO\(_2\) emission goals, and is making progress fast.

A jet engine that consumes 30% less fuel than today’s powerplants: that, in a nutshell, is the bold-but realistic-goal that Safran has set with the open rotor. This program unfurling under the Clean Sky European initiative is harnessing technology that will bring a clear cut from today’s jet engines architecture. This new type of engine comprises two distinct parts: a conventional gas generator, and a turbine driving two counter-rotating unducted fans. Those fans will propel the aircraft. "An aircraft engine's efficiency and consumption depend on the amount of air the fans draw and eject at slow speeds," Snecma (Safran) R&T Director Pierre Guillaume points out. "With the open rotor, we will be able to considerably increase that drawn air flow because we won't have any ducting around the fans. And that will improve consumption and cut CO\(_2\) emissions."

Noise and aerodynamics first…
The open rotor's promising efficiency levels notwithstanding, there are still a number of challenges to tackle, starting with noise. "We are confident about this issue, after the tests we ran in July 2013 in the ONERA wind tunnel in Modane," Pierre Guillaume explains. "The open rotor's noise level should be similar to the LEAP's, i.e. 10 dB below the engines flying today."

These first tests, on a 1:5 scale model, led to a new campaign at the end of the year, to test the fans’ aeronautical performance. "We measured the twinned fan thrust to make sure it matched our calculations," Pierre Guillaume adds.

... Then mechanical performance
"After the tests at the end of 2013, we will be focusing on building a full-size prototype. That prototype should be ready for the bench in 2016. This stage will be particularly complex because all the rear components rotate. We are going to be able to test the propulsion module with the reduction gearbox, control units and control system governing blade pitches. We will use the gas generator on the M88, the engine powering the Rafale, which we are already manufacturing today," Snecma’s R&T Director explains.

This demonstrator, which Avio Aero (GE), GKN and Aircelle (Safran) are also working on, should start its first flight tests on an Airbus A340 in 2019. "If we want to stay on track for entry into service in 2030, we need to move fast, because certifying this new engine generation will take time-and take extensive discussions with the relevant authorities," Pierre Guillaume rounds up.

(1) Advisory Council for Aeronautical Research in Europe