Developing solutions for quieter aircraft

The number of aircraft in circulation will have almost doubled between 2000 and 2020. Noise reduction therefore represents a regulatory, environmental and commercial challenge for engine and aircraft manufacturers. Safran is active in the major research programs in this field.

For several decades now, noise standards in aeronautics have been becoming increasingly stringent, primarily reflecting environmental and quality of life related imperatives: aircraft noise is harmful to local residents, ground staff and passengers. To get a head start on the ACARE\(^1\) targets (a 50% reduction in perceived noise by 2020) and the standards set by the ICAO\(^2\), Safran companies are working together to improve the acoustic performance of their equipment.

Dedicated teams are playing a central role in the key aeroacoustic programs, particularly in the Iroqua\(^3\) initiative. They are developing research partnerships with airframers, helicopter manufacturers and the biggest French and European laboratories, including Onera and the DLR\(^4\). Tackling this challenge calls for the deployment of significant human and scientific resources: the last decibels will be the hardest ones to eliminate!

**Research engines**

As the main source of noise during takeoff, engines will be the focus of all research efforts. "Tremendous progress has been made: excessively low bypass rates were the major factor in the noise generated by the older generation engines," points out Francis Couillard, Director of Environmental Policy at Snecma (Safran). "By increasing the rates, we significantly reduced the velocity of the air coming out the nozzles and therefore the jet noise\(^5\). Our efforts have concentrated on the fan architecture in particular." There are many areas for further development: aerodynamic blades, new, acoustically absorbent materials, chevron nozzles and so on. Reducing combustion noise – deemed "inaudible\(^6\)" today – also ranks among the priorities.

The nacelles are also increasingly efficient at trapping residual engine noise at source. "The four Airbus A380 engines emit a noise level close to the two A320 engines," explains Frédéric Boubila, head of acoustics at Aircelle (Safran). "Our nacelles are equipped with a honeycomb composite skin that absorbs part of the sounds." New technologies, currently under study, will further improve efficiency. The principle is to produce a counter-noise from miniaturized speakers to neutralize the engine sound waves.

**One noise may hide another**

The progress is such that sounds previously considered as "inaudible", because masked by engine noise, are at the heart of the concerns of acoustic engineers. This is the case of the sound generated by landing systems, which by nature are not very aerodynamic. "It is estimated that they are responsible for 20-40% of the perceived noise in the approach phase", explains Antoine Boillot, R&T landing gear manager at Messier-Bugatti-Dowty (Safran). "This issue has only arisen recently: for now, only the most obvious improvements have been made, such as sealing the ends of the pivot pins, which can generate whistling noise." Noise can also come from the slowing or the separation of air and from turbulence caused by the landing gear when it is lowered. Solutions under consideration are focusing on the design of the landing gear and on adding fairings to make it more aerodynamic, while taking into account constraints of size, weight, flight safety and maintenance.

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1. Advisory Council for Aviation Research and Innovation in Europe
2. International Civil Aviation Organization
3. Initiative de Recherche pour l’Optimisation acoustique Aéronautique
4. Deutsche Forschungsanstalt für Luft und Raumfahrt
5. Jet noise is linked to the expulsion of gas to the rear of the engine, which generates turbulence through contact with ambient air.
6. When two noise sources are near and simultaneous, if one of the two noises is 25% lower than the dominant noise, it is considered as "inaudible". This is the case of combustion noise relative to discharge and fan noise.

**Turbomeca’s drive for decibel reduction**

Being located in close proximity to cities, most heliports impose very strict regulations. "We are leading the field in research on the noise generated by helicopter turbines," comments Eric Bouty, lead manager at Turbomeca (Safran) for this question. "There are effective solutions to reduce the noise emitted by air inlets and outlets. Turbomeca has been studying them for a long time now, with convincing results: less than 7 dB input and less than 5 dB output."
"Efforts are now focused on reducing engine noise at source. In this context, Turbomeca actively participates in the main European research programs."