CEAS & X^2-Noise workshop

Aeroacoustics of new aircraft and engine configurations

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Panel discussion

Panel: Gregor Dirks, Airbus; Andrew Bradley, Rolls-Royce; Ilan Kroo, Stanford.

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Noise versus emissions improvements: are they necessarily contradictory? Can a quiet aircraft configuration be more efficient at the same time, or will we necessarily have to "pay" for silence?

Some technologies are beneficial to both noise and emissions. For example, increased bypass ratio initially benefited both noise and fuel burn, but further increases penalise fuel burn because of increased weight.

Breakthroughs in both noise and emissions can result from improvements in other technologies (e.g. low-weight nacelles could result in higher bypass ratio engines being feasible, reducing noise and improving performance)

We need to be imaginative to minimise the "cost" of low-noise features (e.g. Can acoustic shields perform a structural duty and therefore not introduce such a performance penalty?)

Configuration effects can be important; a stopper for one configuration may be irrelevant for another configuration (e.g. a longer landing gear might be required for a higher bypass ratio engine for a conventional but not for a novel aircraft configuration).

Are very low noise aircraft concepts worthless if they are incompatible with conventional aircraft configurations (concepts such as aerodynamically integrated landing gears, partially buried engine intakes)? Will we really see new configurations flying in 2025 or 2050 or just aircraft with a high wing and very or ultra-high-bypass-ratio engines?

There is a preference in the market for mature designs; airlines won't buy new configurations if they show less than typically a 15% reduction in operating costs. A new configuration should target typically a 50% improvement and will take typically 5-10 years for a design to reach maturity. Many technologies need to be proven for the blended-wing-body aircraft. Furthermore greater integration of engine and aircraft might be difficult for operational reasons.

However, many low-noise principles can be adopted with less radical changes, and also maturity can be achieved initially in military or marine applications (e.g. a military blended-wing-body aircraft). Furthermore, it is important to scope the boundaries of what is achievable with novel low-noise technologies and to be able to judge their applicability.

Will we see aircraft with new “steep” landing procedures? Is extreme high lift (C_L) the answer to the noise problem?

Aircraft with 4½º or 6º landing glide slopes are being investigated. A major issue will be the air traffic management’s integration of such aircraft with older aircraft. Engine spool-up time is potentially a limitation associated with landings at reduced thrust, though this might be alleviated by more-electric engines.

Is it possible to include aircraft noise issues in the concept or preliminary design phase for radically new aircraft or do we not have sufficiently accurate source models? For example, airframe sources may strongly depend on the detailed design, e.g. gap/overlap of slat; how can this be incorporated in the concept or preliminary design phase?

There is a need for reliable low-fidelity codes without too many variables in the concept or preliminary design phase to allow any optimisers to function. One challenge to including any high-fidelity analysis is dealing with strong sensitivities, avoiding blindly applying high-fidelity codes. Such analysis is often more appropriate in the detailed design phase.

Will current EU programmes deliver the technology needed for the ACARE aircraft?

Whilst programmes like VITAL and NACRE are developing the technology which might deliver a 10dB reduction in noise, much further work is required because of the issues of:

- simultaneously achieving other ACARE objectives such as reduced emissions and fuel burn
- much of the technology being difficult to implement by 2020
- developing technology to continue delivering noise reductions beyond 2020