

POWERFLOW FOR PROPULSION NOISE



3DEXPERIENCE®

Noise from aircraft jet engines during take-off is the dominant source of community noise. Government regulations of community noise are getting more and more stringent in most countries, creating significant challenges for aircraft manufacturers forced to meet these ever-increasing regulatory requirements.

The main causes of propulsion noise are:

- Jet noise —The sound created by the turbulent mixing of the jet and the surrounding air
- Fan noise — The interactions of turbulent flow in the turbine with rotating fans, compressors, and turbine systems
- Installation noise —The noise caused by interaction of the jet with other components of the airplane (in particular, high-lift wings)

Technical Challenges

The prediction of jet and fan noise is among the most challenging tasks for computational fluid mechanics. The noise generation mechanisms are not fully understood yet — even on a theoretical level. Prediction methods based on traditional CFD technology require use of advanced LES turbulence models, for which productive use for complex real-life engine geometries is still many years away. Therefore, propulsion noise engineers must rely almost exclusively on experimental tests, which have significant limitations. Most tests cannot be performed at installation velocities and are generally limited to stand-alone configurations of the engine only. In addition, installation noise can be tested only during late-stage flight tests, which leads to high safety margins and overdesign to avoid noise-related certification issues.

SIMULIA Solution

PowerFLOW's innovative Lattice Boltzmann-based physics has the potential to overcome the issues that prevent broader use of CFD for engine noise prediction. PowerFLOW has been shown to have fundamental advantages in the prediction of the complex noise mechanisms in turbulent jets. Together with the proven ability to represent complex geometries (such as modern chevron design), PowerFLOW opens completely new possibilities for jet and installation noise prediction.

For the prediction of fan noise, PowerFLOW's easy-to-use rotating geometry functionality enables you to predict noise caused by the complex interaction of rotating fan and stator —taking into account all the geometry details that can potentially impact noise generation mechanisms.