

Multi-fidelity modeling for supersonic aircraft exhaust noise

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Cost Share Partner: in discussion

Research Approach:

- In consultation with Project 59 and other project partners in ASCENT define the plans for high-fidelity simulations and jet noise modeling
- Develop and validate high-fidelity jet noise predictions for baseline configurations
- Develop and validate RANS-based jet noise predictions for baseline configurations
- Develop and validate high-fidelity jet noise predictions for configurations with noise mitigation concepts
- Develop and validate RANS jet noise predictions for configurations with noise mitigation concepts

Objectives:

In collaboration with ASCENT partners in Project 59, develop multi-fidelity physics-based analyses for supersonic aircraft exhaust noise.

The main goals are to develop improved jet noise prediction methods and better understand the uncertainty associated with the noise predictions for a range of engine cycle parameters and operating conditions relevant for civil supersonic aircraft.

Project Benefits:

Aircraft and engine companies, and organizations such as NASA, FAA, and DoD R&T community would also benefit from the improved methods and tools. Ultimately, supersonic jet noise tools with predictive capabilities can be used to design better noise mitigation systems and to provide estimates of noise for certification studies.

Major Accomplishments (to date):

- LES of primary nozzle and primary+secondary buried nozzle (GaTech geometry)
- Refined LES and comparison with GaTech data (underway)
- Development and validation of far-field noise propagation model (Adjoint-Green's function)
- Planning for Y2/Y3 (noise reduction concept) -> NASA Plug20 nozzle

Future Work / Schedule:

- LES based noise prediction GaTech nozzles (Year 2)
- LES of NASA Plug20 nozzle –Internal plug (Year 2)
- Validation of RANS based acoustic modeling –GaTech nozzle (Year 2)
- LES-based noise predictions NASA Plug20 mixer nozzle (Year 3)
- Validation and improvement of RANS based acoustic modeling –GaTech nozzle and NASA plug20 nozzles (Year 3)