ASCENT Project 59C

Modeling Supersonic Jet Noise Reduction with Global Resolvent Modes

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Cost Share Partners: Boom, Gulfstream

Objective:

Develop a rapid capability, using physics-based models, to estimate changes in jet take-off noise due to changes in nozzle design and engine cycle

Project Benefits:

Reduce sound environmental impact due to anticipated return of supersonic civilian transport aircraft

Improved workflows and reliability for industry partners to make noise-related design decisions

Research Approach:

Utilize input-output (resolvent) descriptions of the jet aeroacoustics to link nozzle design and engine cycle choices to their impact on the radiated noise.

Envisioned usage:

1. Compute RANS of baseline nozzle with identified cycle and design parameters
2. Compute input-output operator and its gain sensitivities wrt design parameters
3. Select new cycle and/or nozzle design parameters that reduce gains of far-field noise
4. Return to 1.) with new nozzle and repeat

Major Accomplishments (to date):

- Automated workflow of CAD → RANS solution developed, verified and validated against GTRI data
- Input-output operator code & sensitivities developed and verified
- Automated resolvent code for dual-stream jets
- Gain sensitivity trends across parameter spaces consistent with experimental SPL measurements

Future Work / Schedule:

- Develop self-consistent internal calibration for gains using RANS data
- Perform first closed-loop design

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