

# Low Noise Air Amplifiers

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## Objectives

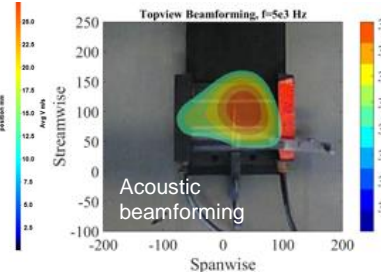
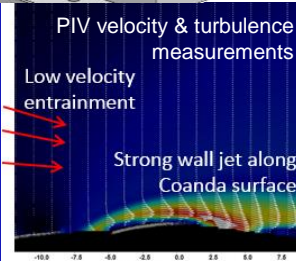
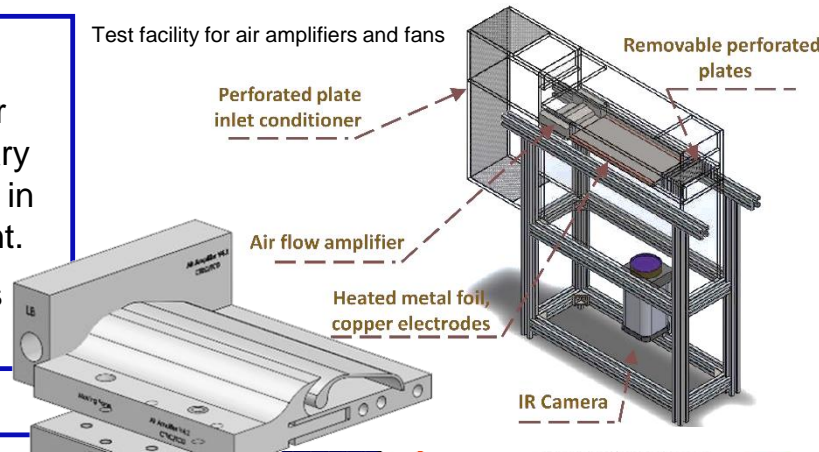
Assess potential of flow amplifier technology to replace/assist rotary fans, addressing key challenges in data center thermal management.

Develop linear air flow amplifiers suitable to confined spaces.

## Approach

1. Modular test setup composed of flow channel with heated metal foil for IR thermography, PIV velocity, PQ curves, acoustic noise testing.
2. Validated aeroacoustics modeling results of hybrid URANS/LES model to help improve air amplifier design for noise reduction.
3. Developed Excel prediction tool for comparison of axial fans vs commercial & CTCR flow amplifier
4. Built interactive lab demonstrator.

Test facility for air amplifiers and fans

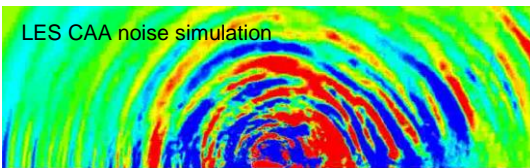


For the same flow rate and loading conditions...

	Axial Fans (Nidec UltraFlo™)	Air Amplifier (Brauer Airmover™)	CTCR Blade Air Amplifier
Operating conditions	At 33% speed ( $n = 7,200$ rpm)	$h = 0.05$ mm $p_i = 2.01$ bar	$h = 0.1$ mm $p_i = 1.45$ bar
Flow rate	Same	Same	Same
Pressure head	High $\Delta p \sim 1 - Q^2$	Moderate $\Delta p \sim 1 - Q$	Moderate $\Delta p \sim 1 - Q$
Power use	10 W	140 W (electr. equiv.)	120 W (electr. equiv.)
Heat transfer	1.00 23 W/(m <sup>2</sup> K)	0.95 22 W/(m <sup>2</sup> K)	1.80 41 W/(m <sup>2</sup> K)
Noise level	55-57 dB(A) $p_{ac} \propto n^5$	58-62 dB(A) $p_{ac} \propto p_i^{1.5}$ (choked)	59-69 dB(A) $p_{ac} \propto p_i^{1.0}$ (subsonic)
Sound quality	Tonality 92-96%	Tonality 51-59%	Tonality 32-36%

## Impact

- ✓ Objective assessment of fan curve, efficiency and noise for amplifier vs axial fans at similar loading conditions:
- ✓ Pros: similar PQ curve, improved cooling, reliability
- ✓ Cons: low overall efficiency, higher noise albeit more broadband, lower tonality



## Related Publications

- Garimella S. V., Persoons T., Weibel J. A., Gektin, V., Electronics thermal management in information and communications technologies: Challenges and future directions, *IEEE Trans. Compon. Packag. Manuf. Technol.* (In press)