Low Mach Number Aeroacoustics R&D at UNSW Sydney
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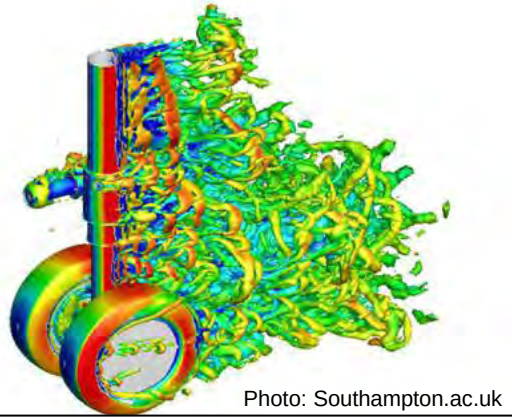


Introduction



Why is it Important?







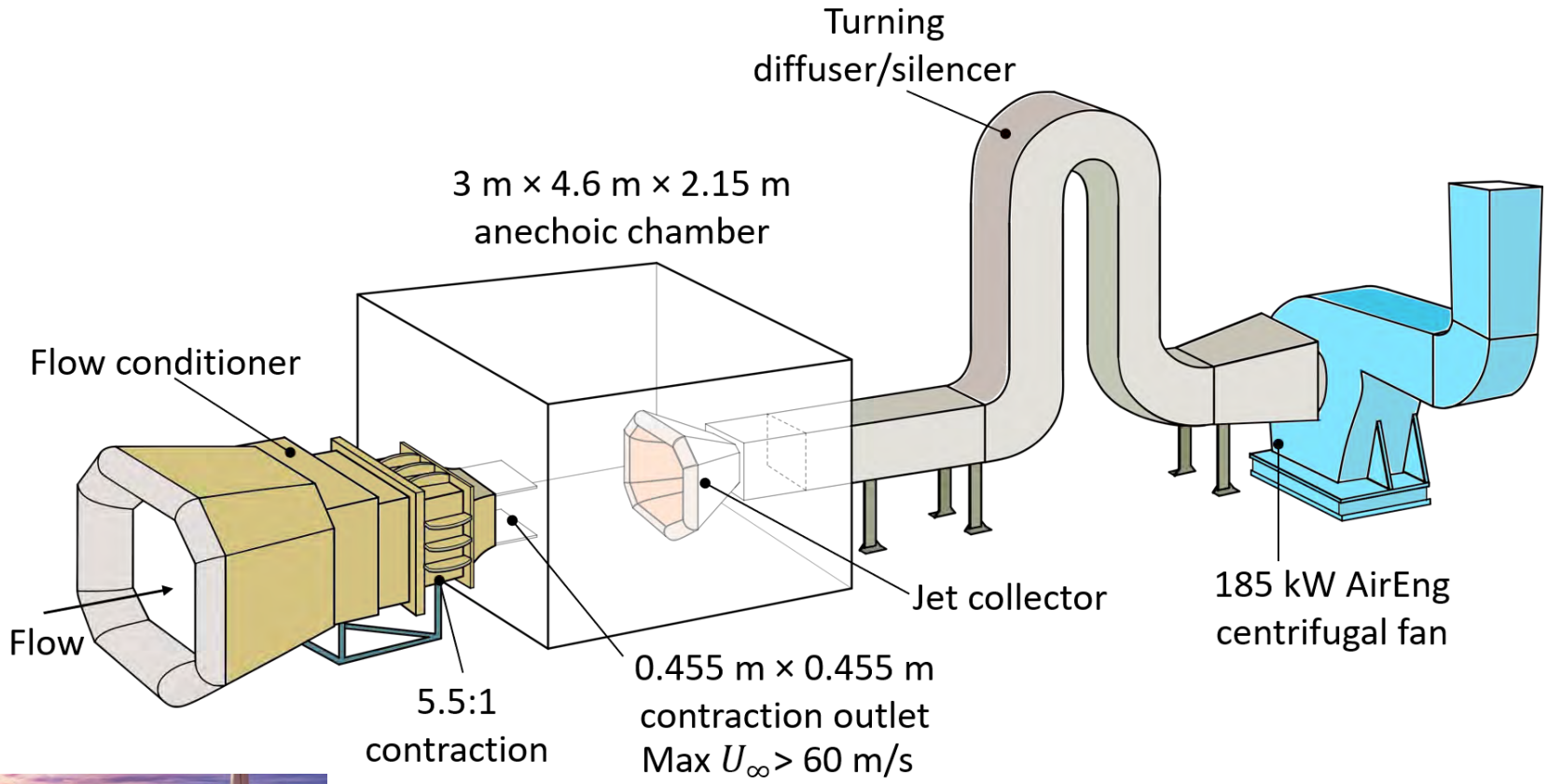
Flow-induced noise is a dominant source of noise for many technologies





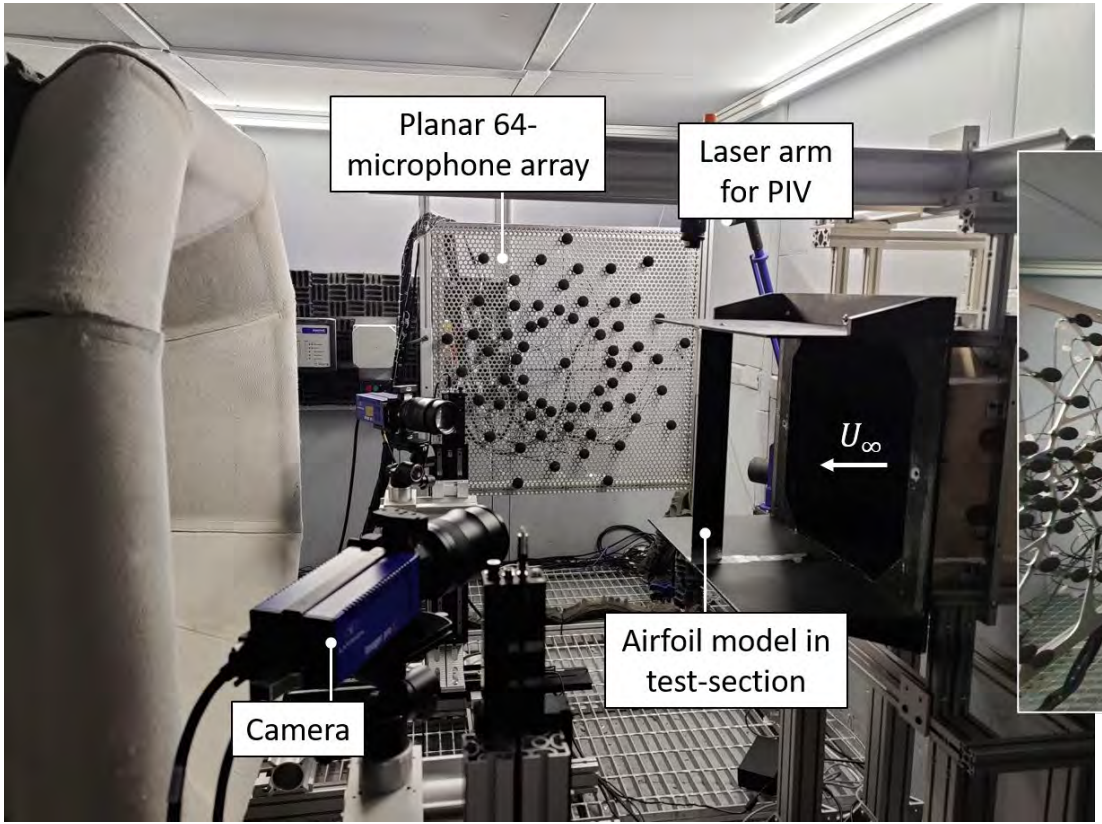


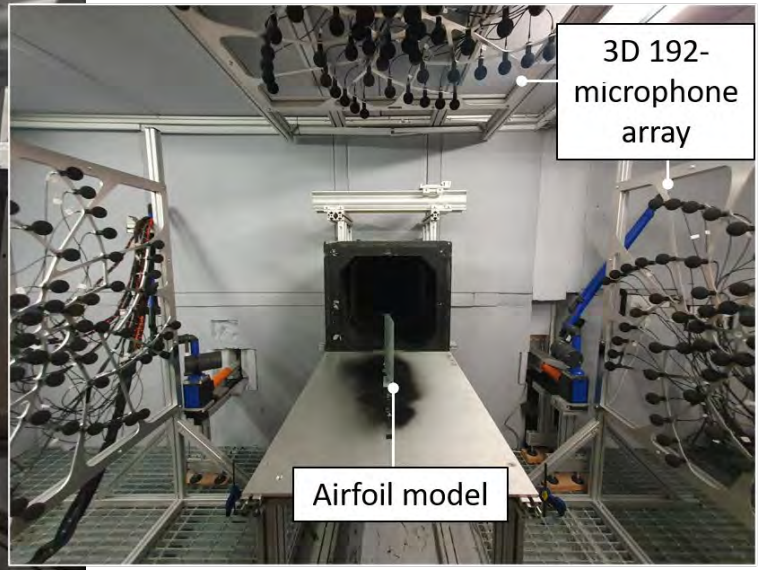
UNSW Anechoic Wind Tunnel





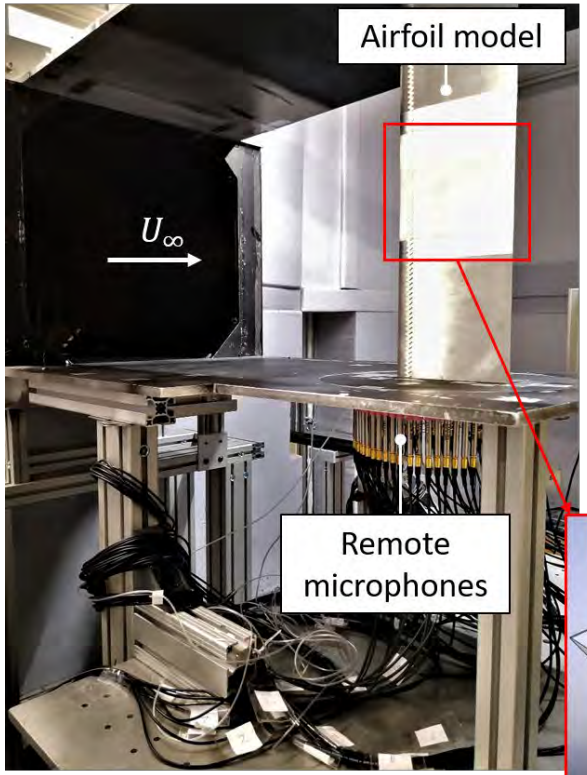
Inside the UNSW Anechoic Wind Tunnel

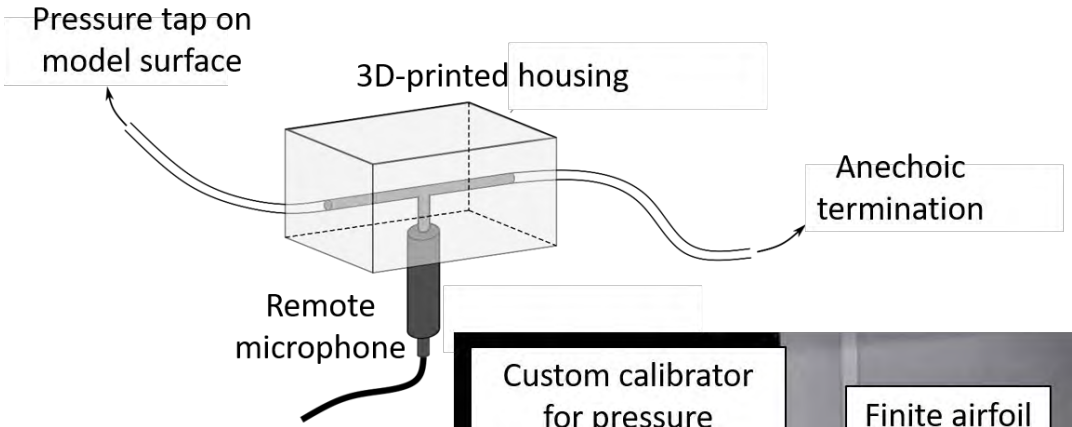


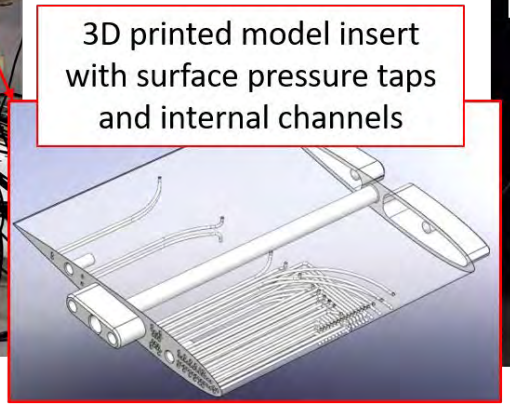


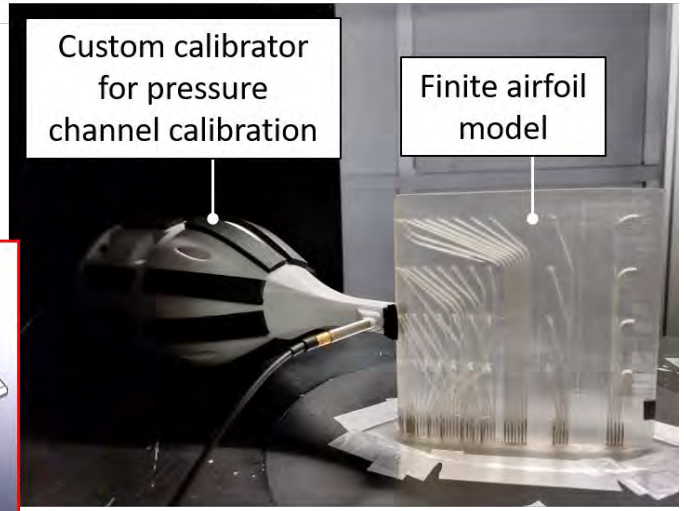


Unsteady Surface Pressure Measurement







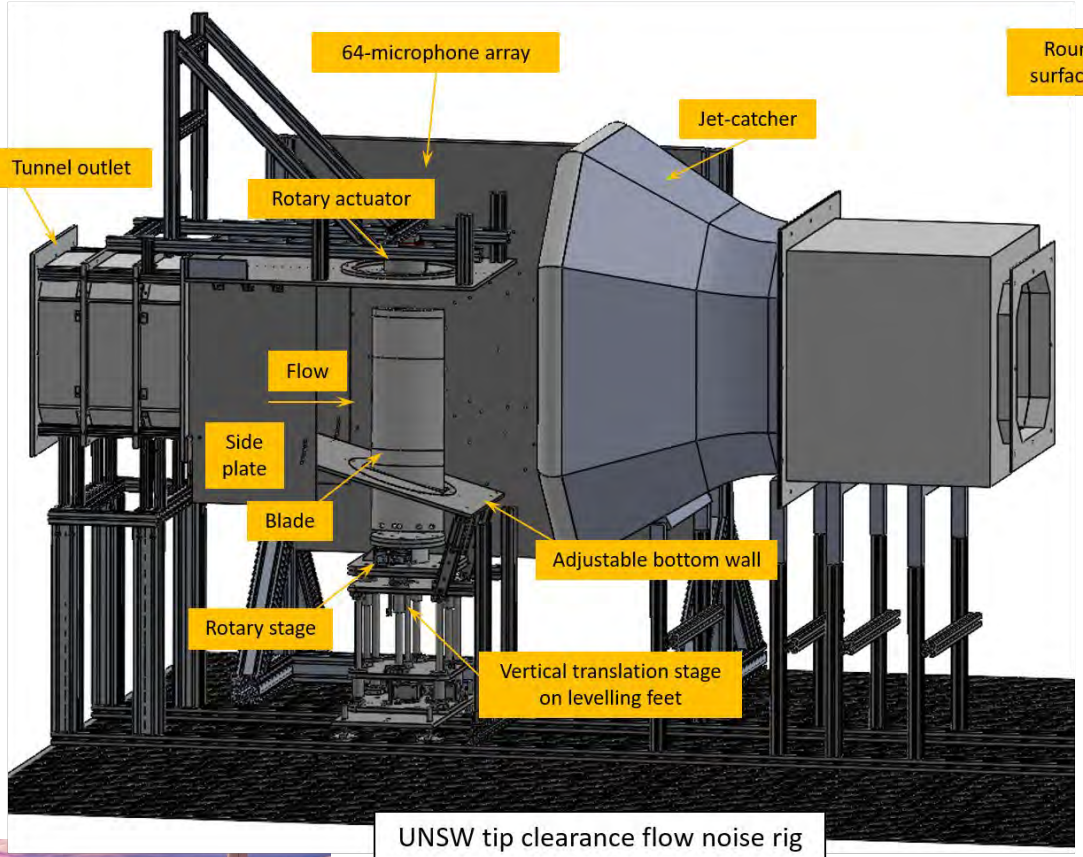




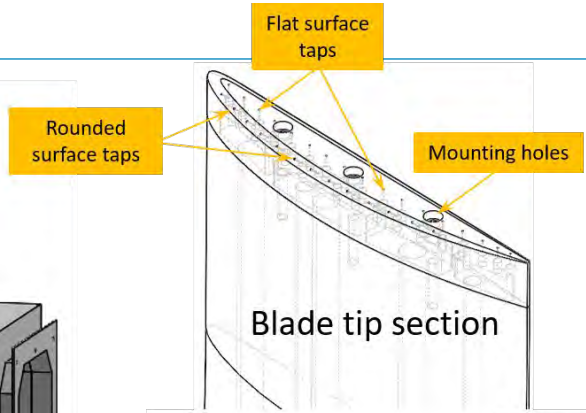
Challenge 1:
What are the noise generation processes in low-Mach number ducted propellers?

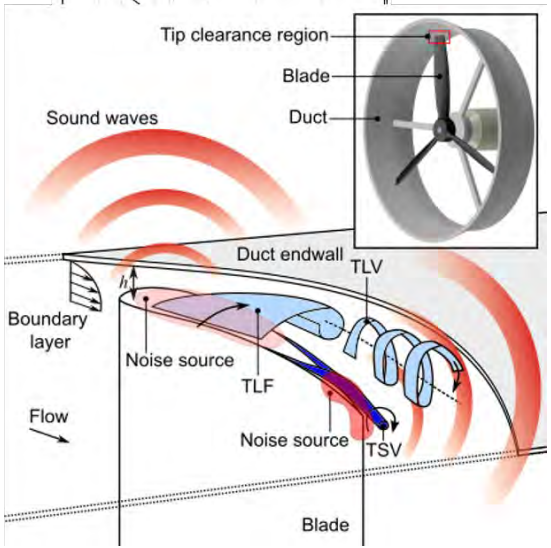


Tip Clearance Noise



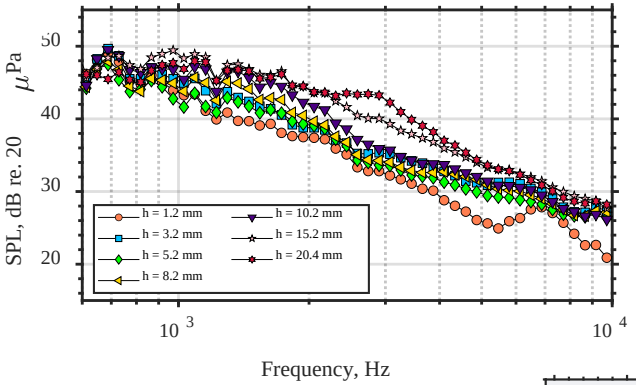
UNSW tip clearance flow noise rig





Tip Clearance Noise

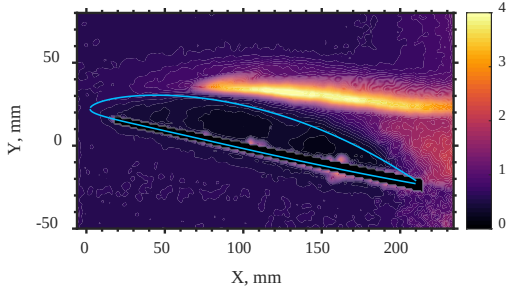
Noise measurements



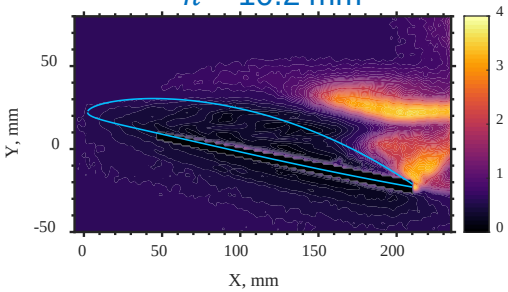
Frequency, Hz

Transverse RMS velocity (v')

h = 5.2 mm

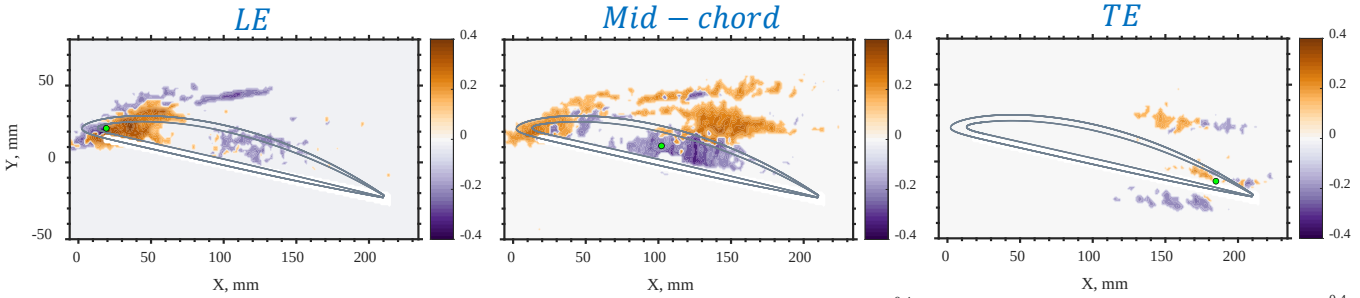


h = 10.2 mm

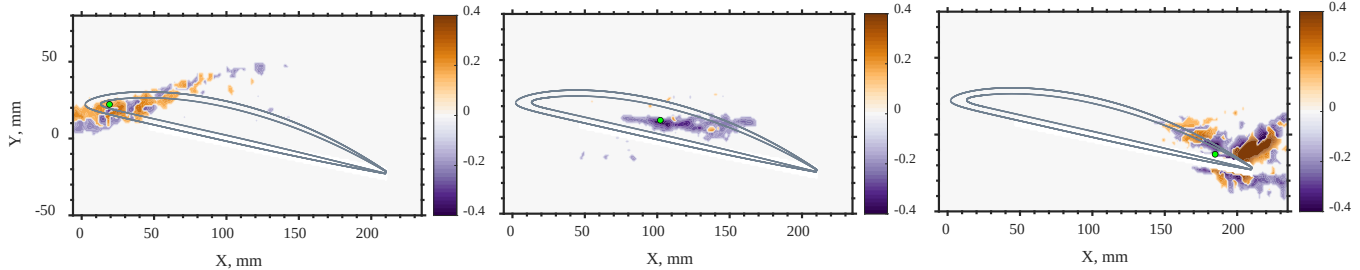


Pressure-velocity space-time correlations ($\mathcal{R}_{pv}$)

h = 5.2 mm



h = 10.2 mm

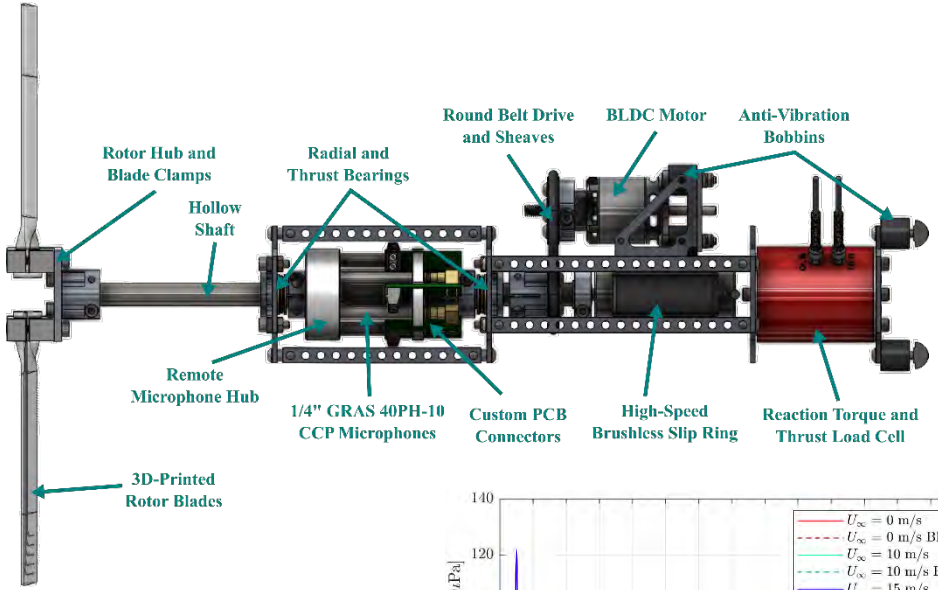


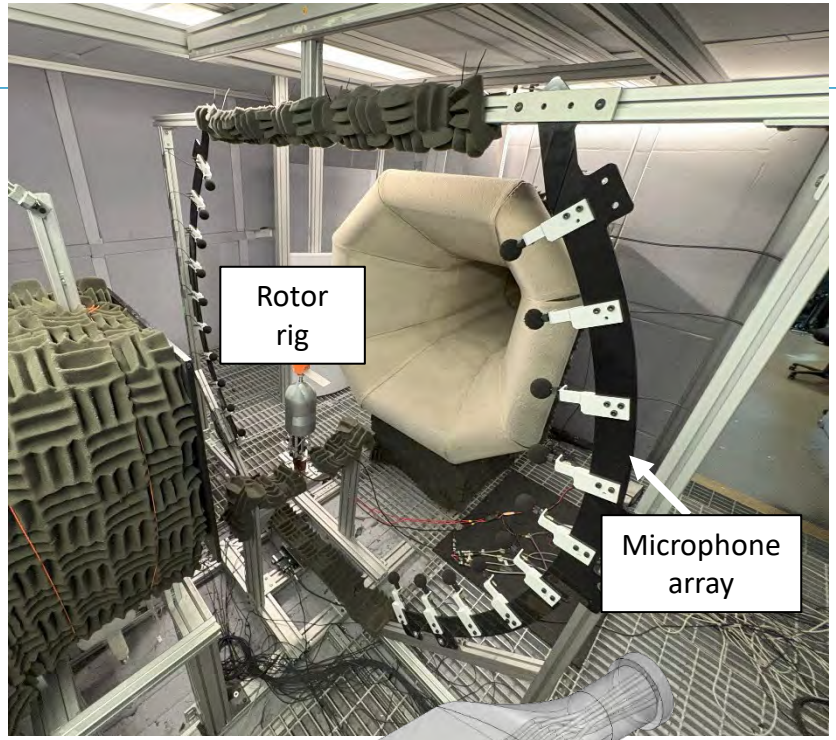


Challenge 2:
How do small UAV propellers produce noise?

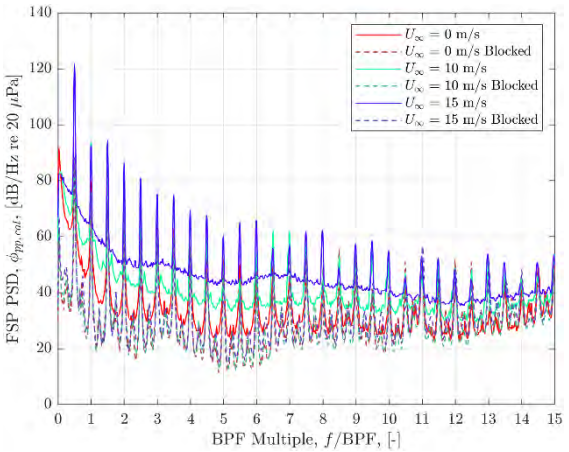


UAV Propeller Noise

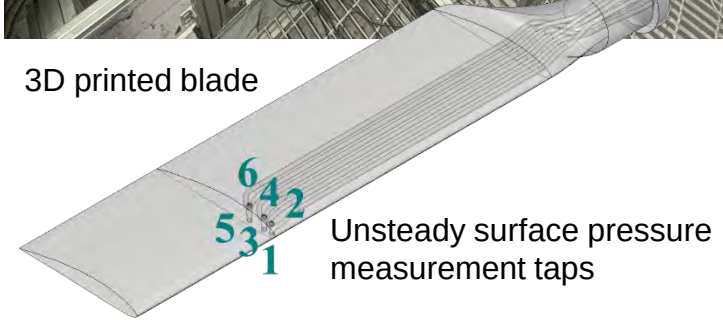




Surface pressure on the rotor blade at 1/8 chord at 4000 RPM



3D printed blade



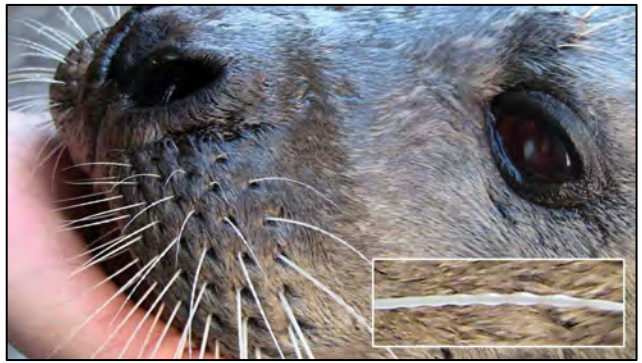
Unsteady surface pressure measurement taps



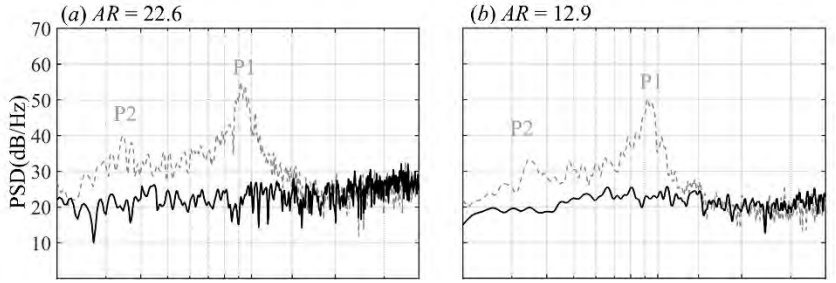
Challenge 3:
How can we develop innovative solutions to noise control?



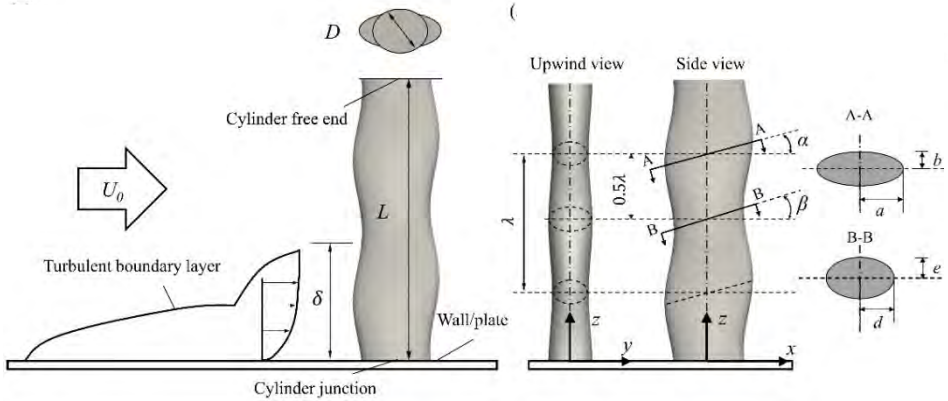
Bio-inspired Bluff Body Flow Noise Control

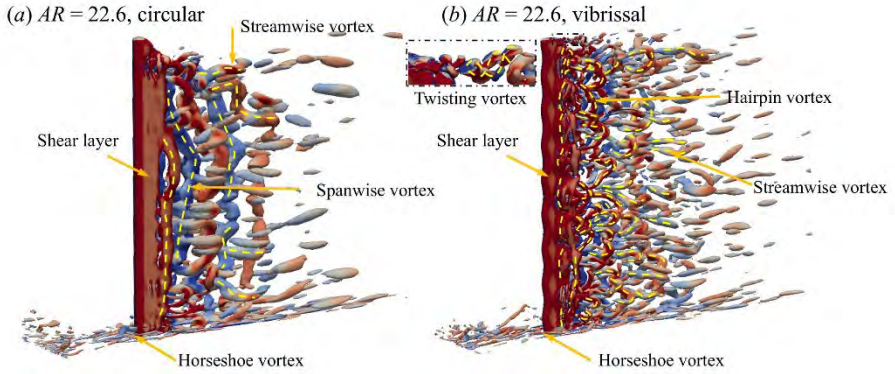


https://asknature.org/strategy/whiskers-sense-prey-movement/



Far-field noise spectra showing noise reduction achieved with vibrissal shaped cylinders





Instantaneous flow structures visualized by Q-iso surfaces



Acknowledgements

I would like to acknowledge members of the Flow Noise Group for their valuable contributions to this body of work, in particular Con Doolan, Charitha de Silva, Manuj Awasthi, Tingyi Zhang, Justin Malkki and Wenyu Chen.

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