Bristol Facilities: Boundary layer Wind Tunnel, Propeller testbed, Pressure Neutral Wind Tunnel and Aeroacoustic Wind Tunnel

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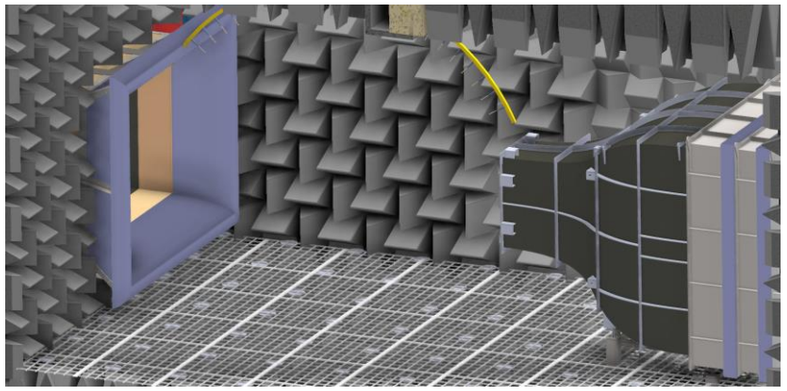
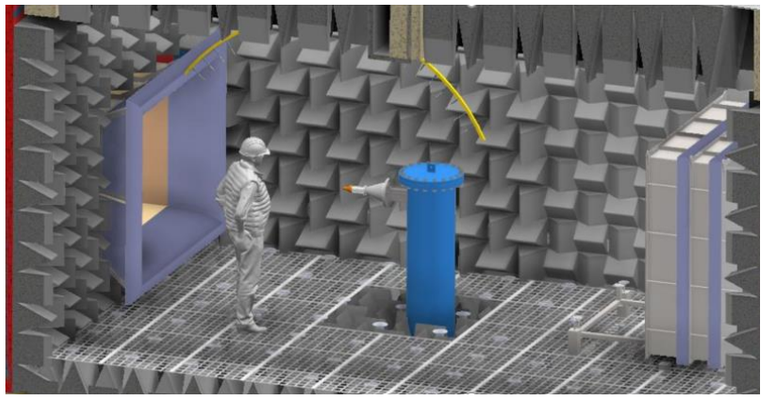
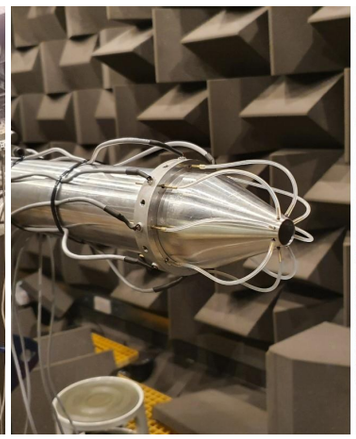
NWTF

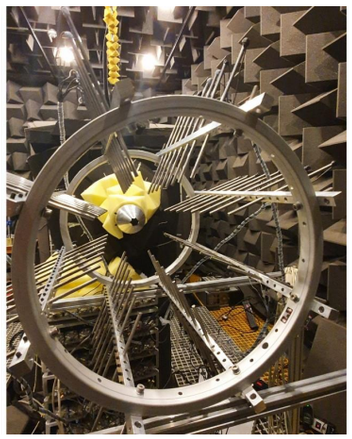
UoB Aeroacoustic Wind Tunnel (NWTF)



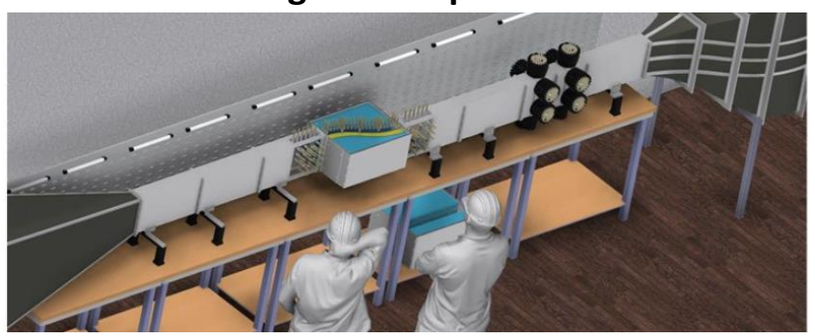
High Speed Jet Facility



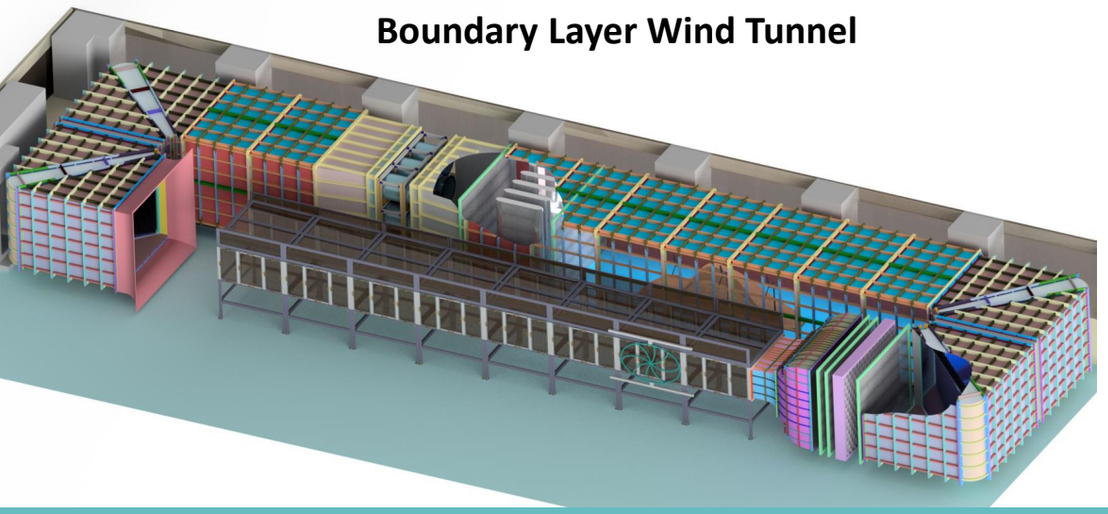




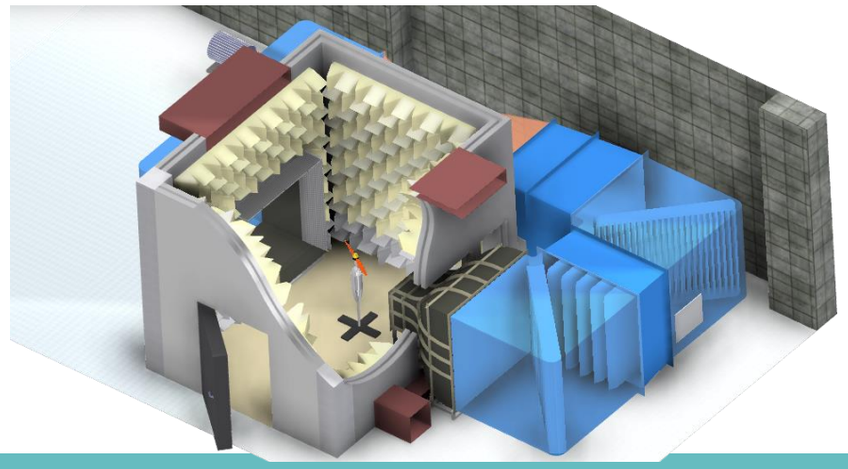
Grazing Flow Impedance Tube



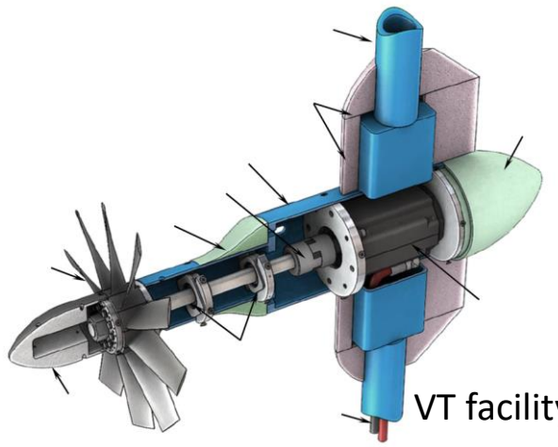
Boundary Layer Wind Tunnel



Pressure-Neutral Acoustic Wind Tunnel



Propeller testbed



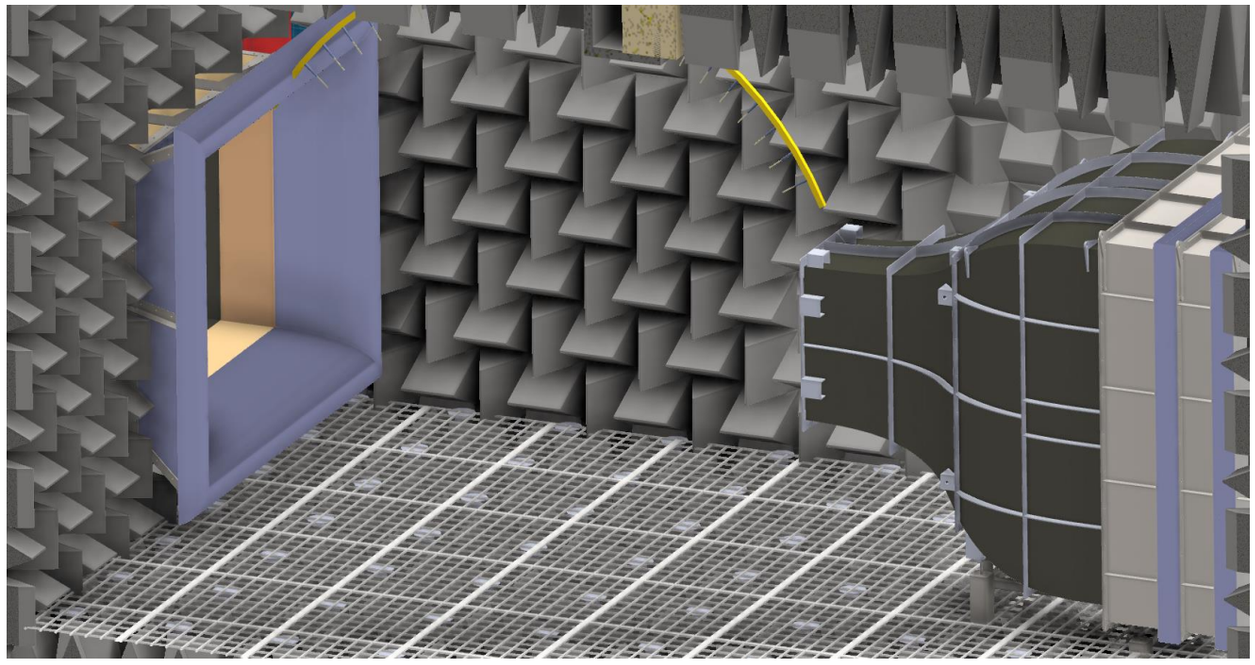
VT facility

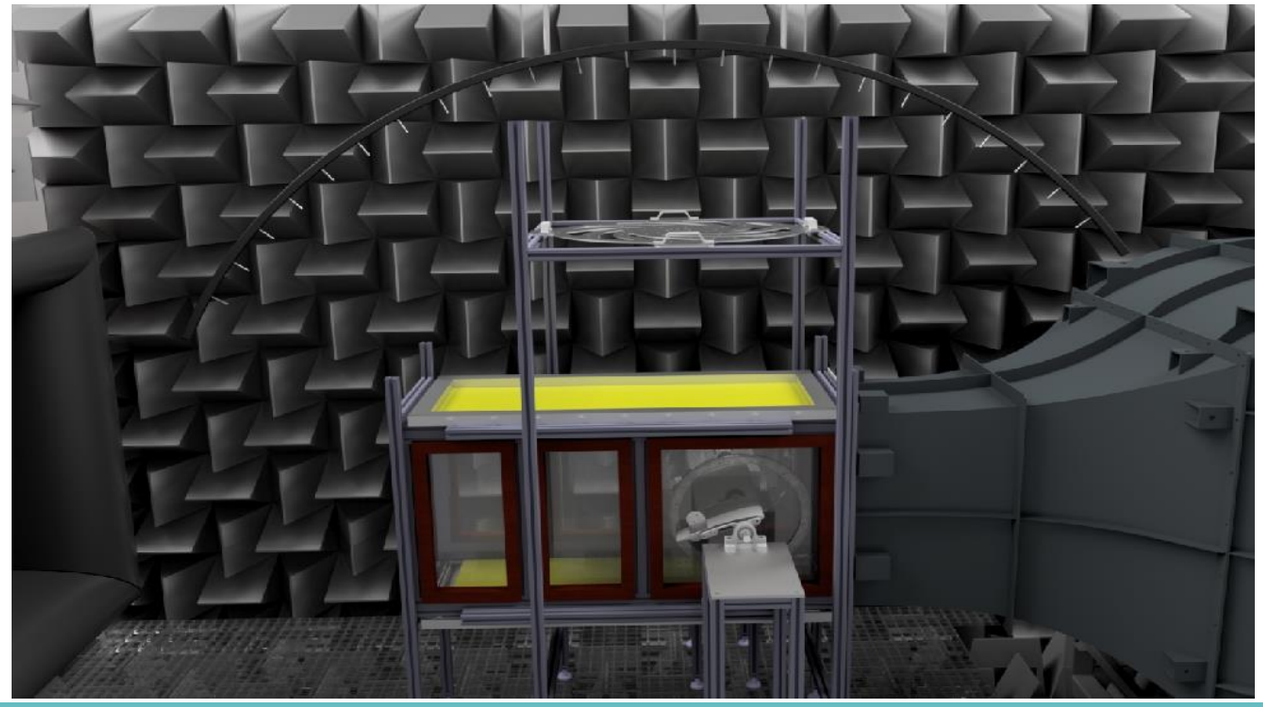
Aeroacoustic Wind Tunnel

Facility specification:

<u>Large acoustic wind tunnel</u>

- Anechoic down to 160 Hz
- Speed up to 40m/s (large nozzle) and 120m/s (letterbox nozzle)
- 140 free-field microphones and Kulites
- Two large beamforming arrays
- Over 160 NI channels
- Hotwire CTA system
- Hotfilm system (48 channels)
- PIV system (2D2C and Stereo)
- Pressure scanner (160 channels)
- Near-field linear arrays

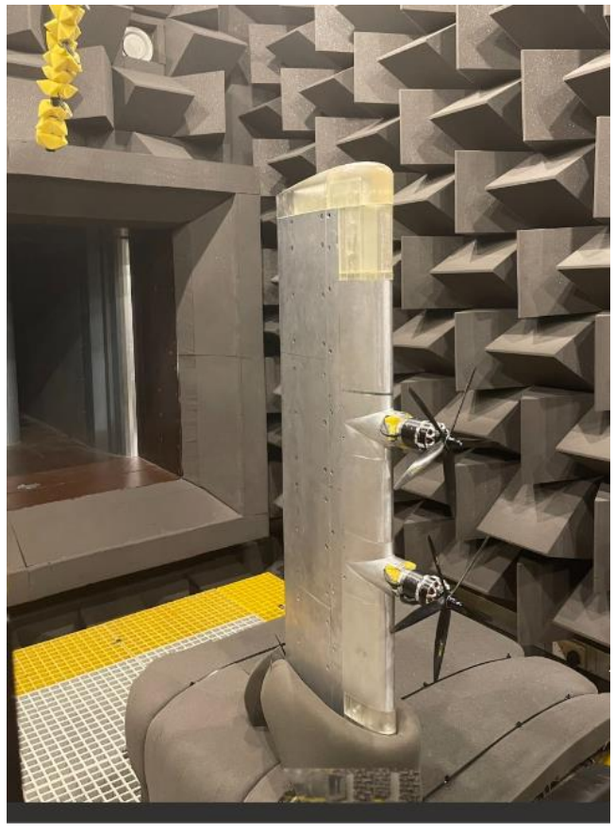


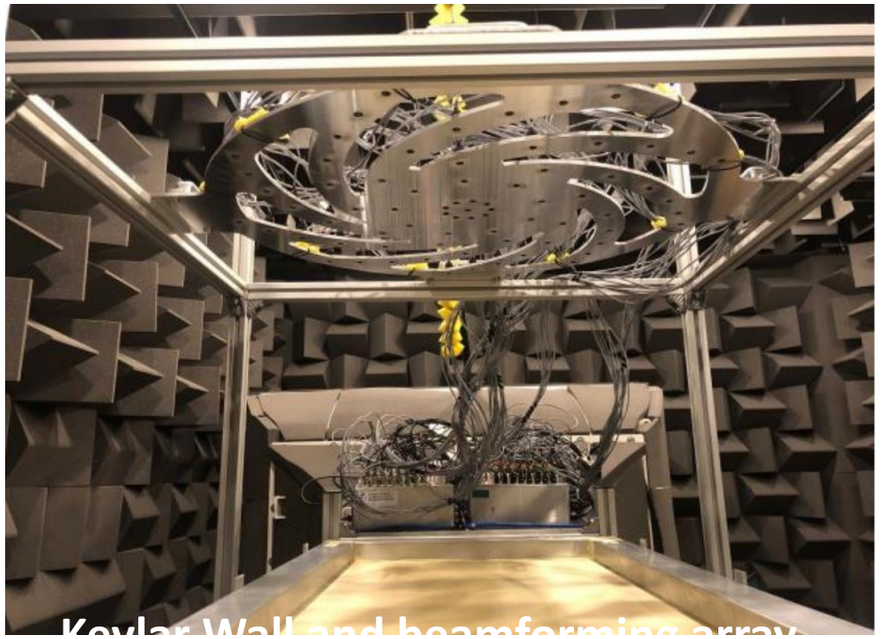


Applications

(1) propellers
(2) wings and blades
(3) high-lift devices
(4) landing gear systems
(5) wall turbulence studies
(6) turbulence interaction studies

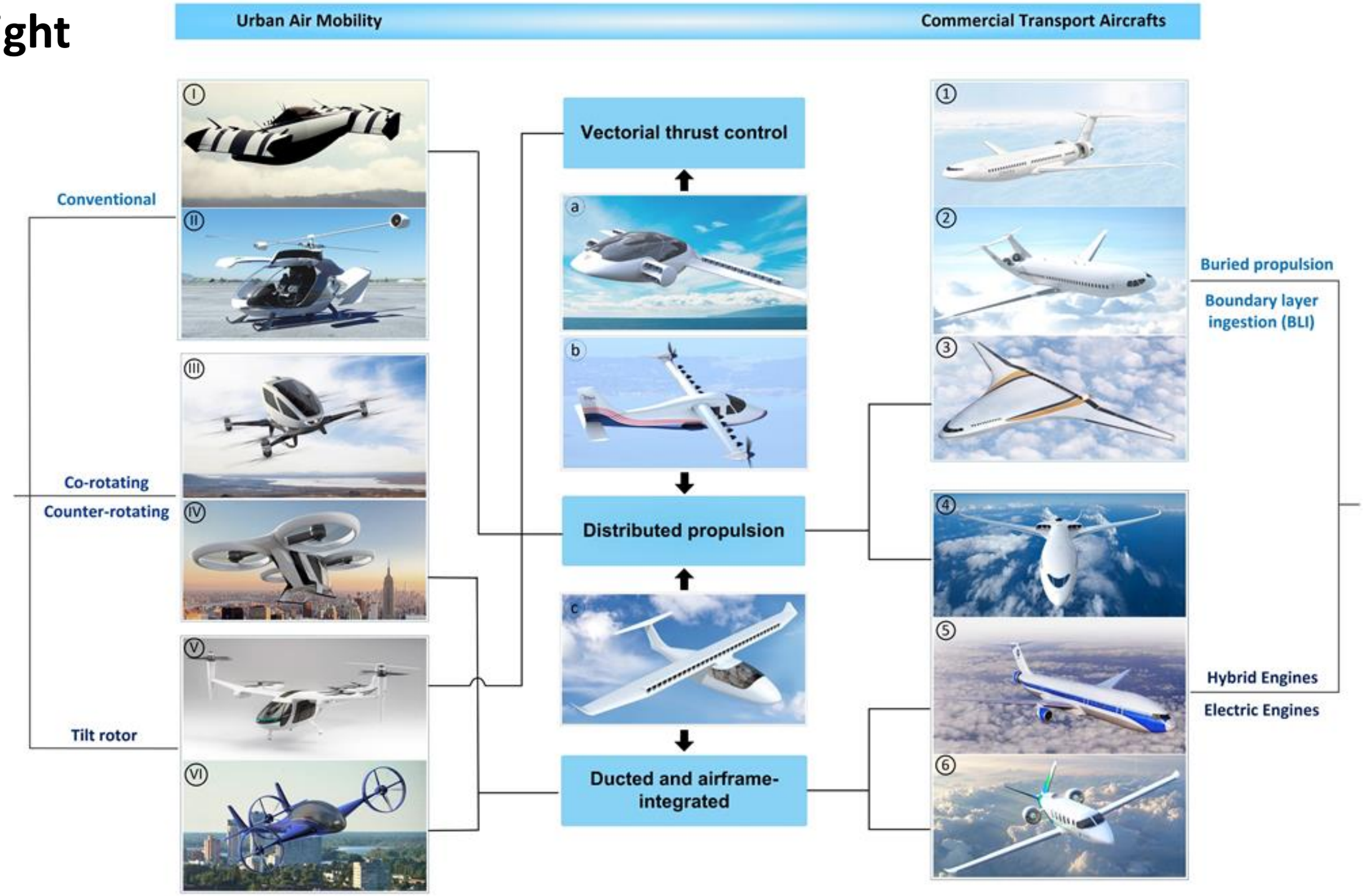
Applications





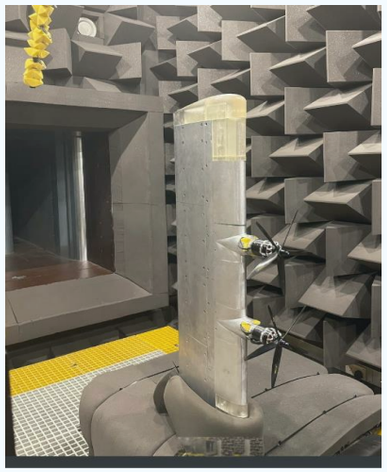
Kevlar Wall and beamforming array

Future Flight



Applications

Distributed electric propulsion



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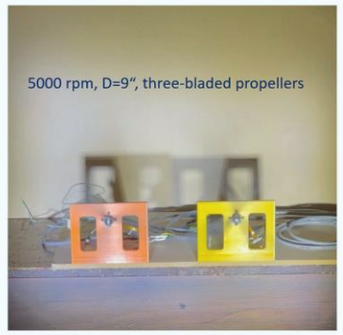
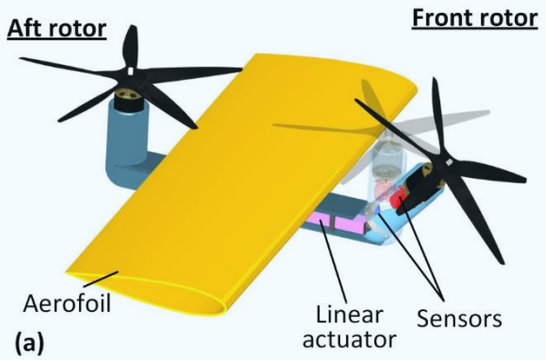
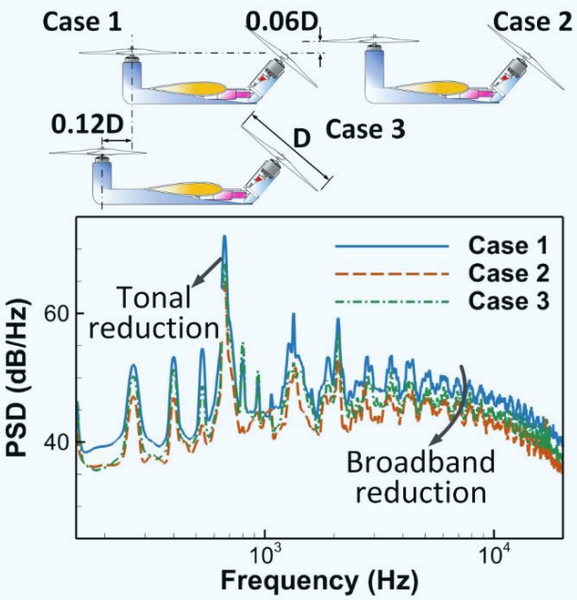
The high-speed camera view of the phased-locked propellers at φ=0°



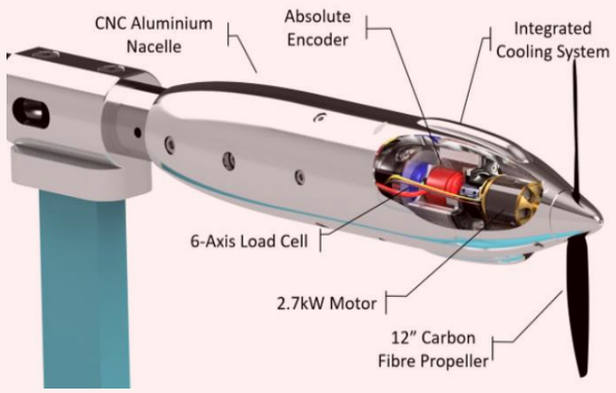
High-Speed camera setup for side-by-side configuration

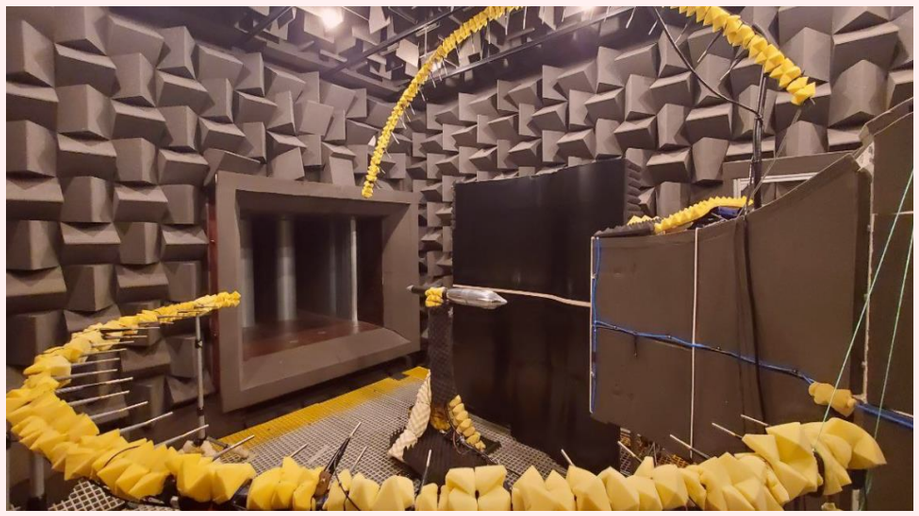
Tandem rotors

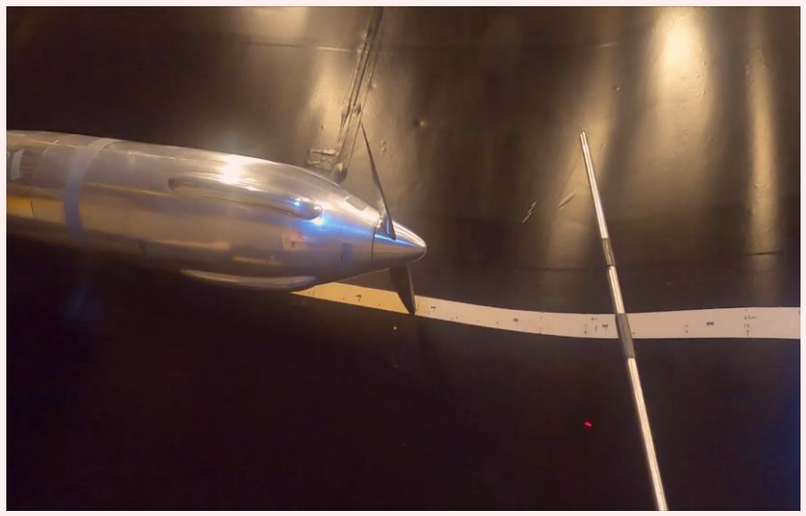




Boundary Layer Ingestion

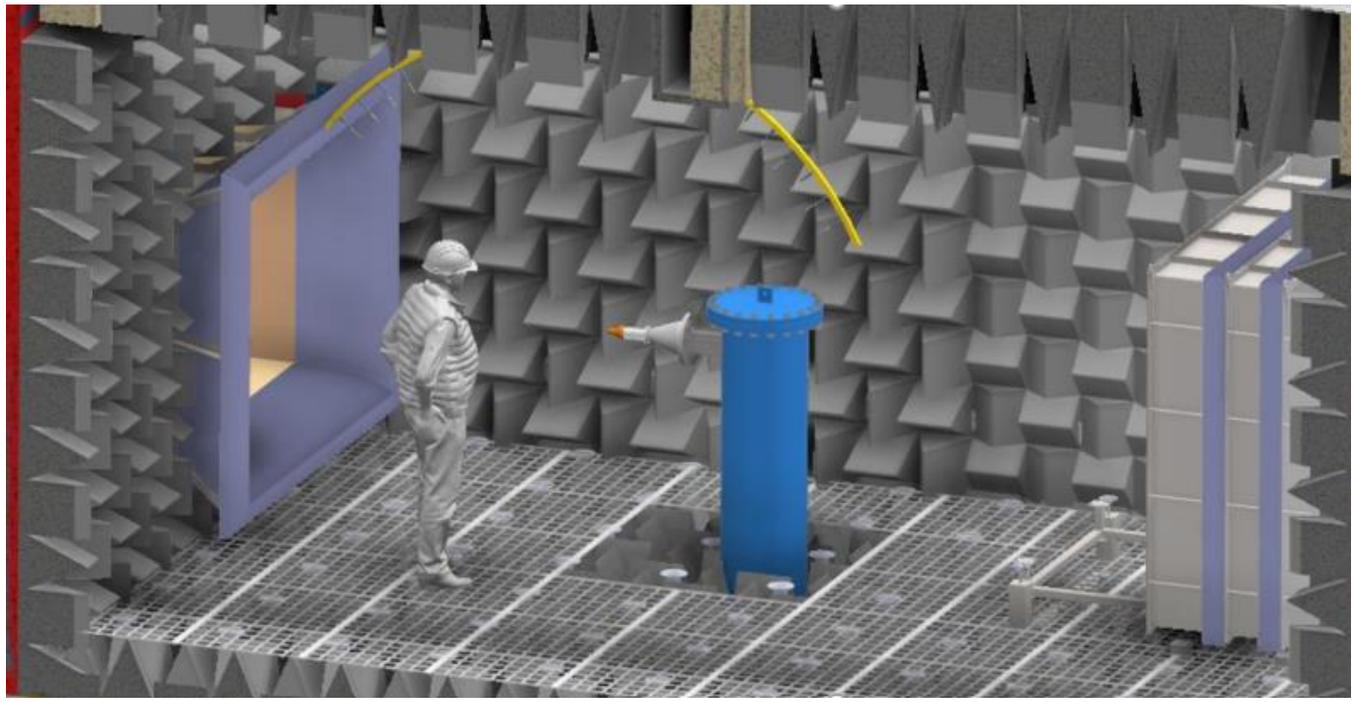


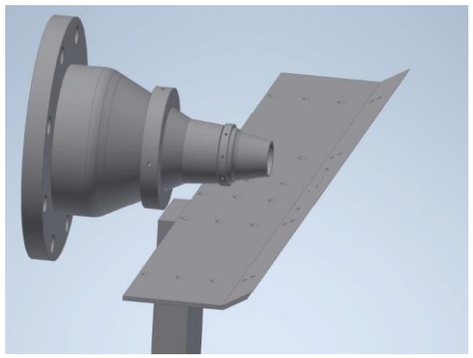


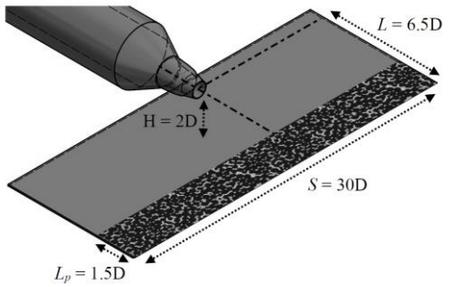


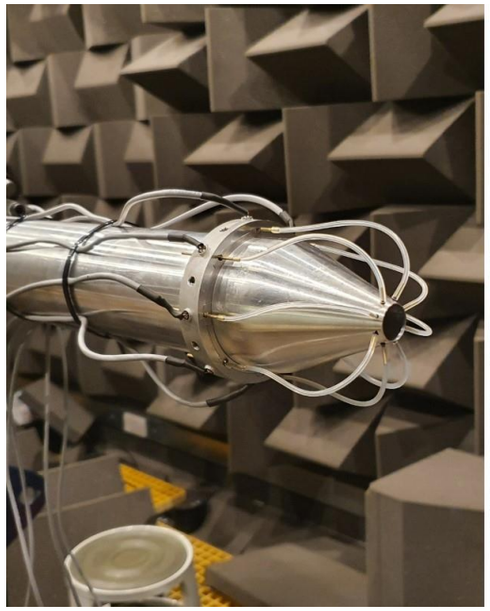
High speed jet applications

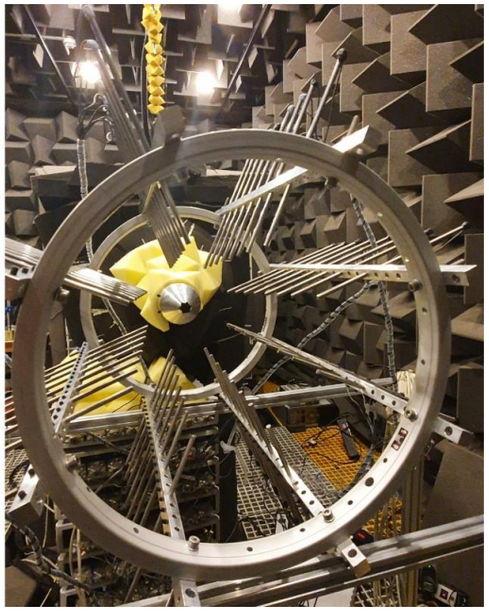
- Far field array with over 70 mics -GRAS 40PL/46BE
- Near-field linear array GRAS 46BE
- Wall-mounted Kulitesensors
- Near/far field array using FG mics 64 mics
- Beamforming arrays (80 mics)
- National Instrument, 10+ PXIe-4499 cards, 160 channels
- TR-PIV
- DantecHotwire –single/cross wires, 90 degree probes
- Schlieren imaging (FASTCAM SA-Z)





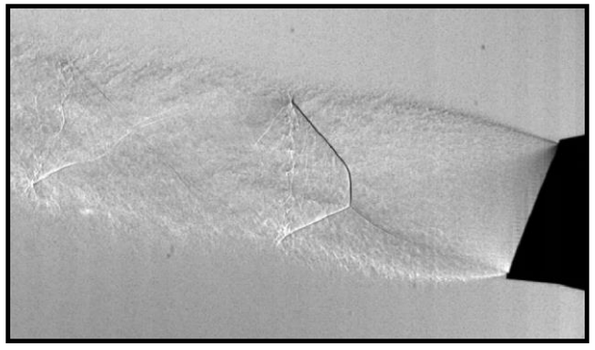


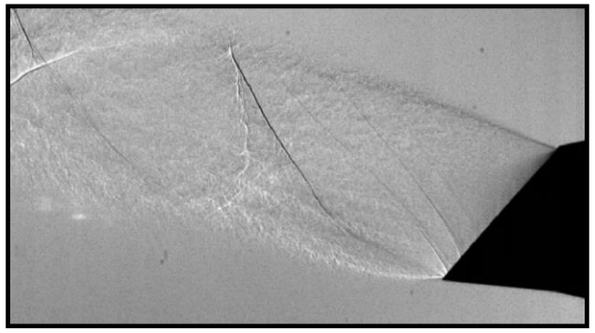


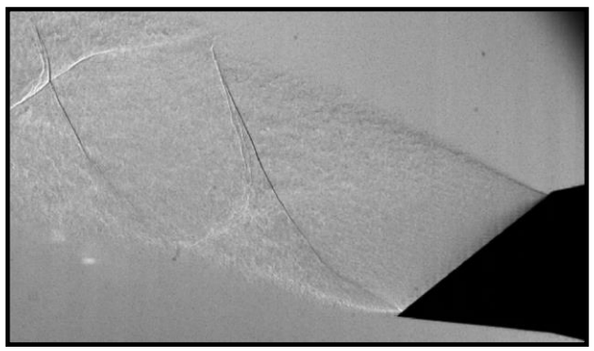


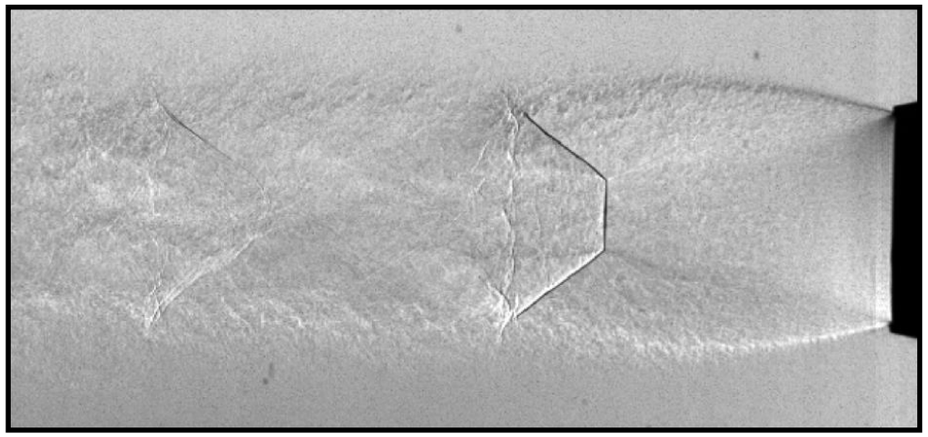
Supersonic jets

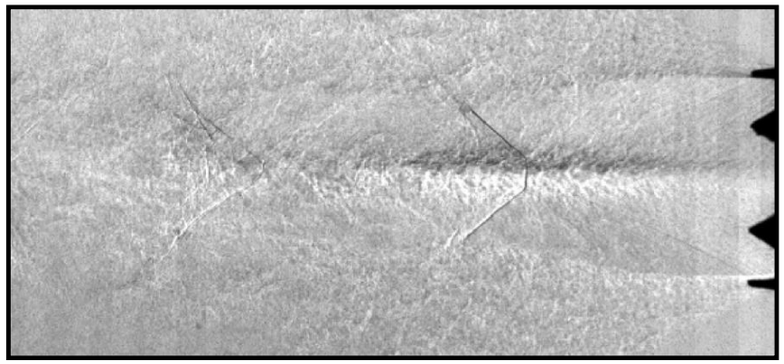
Scarfed nozzle

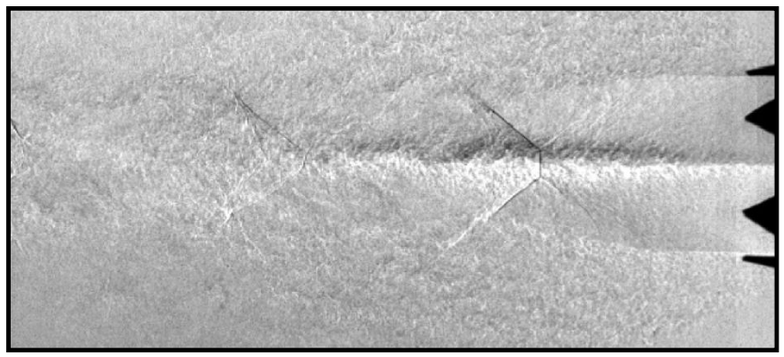


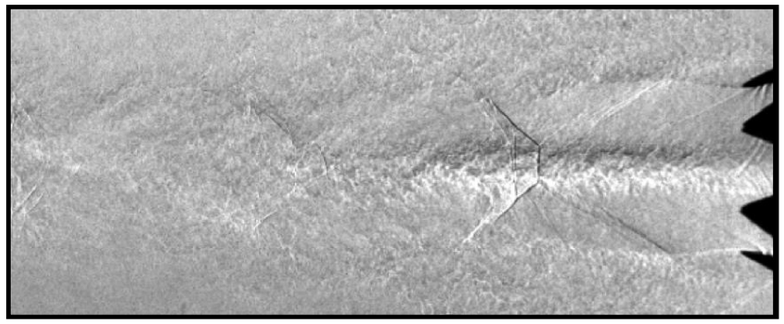












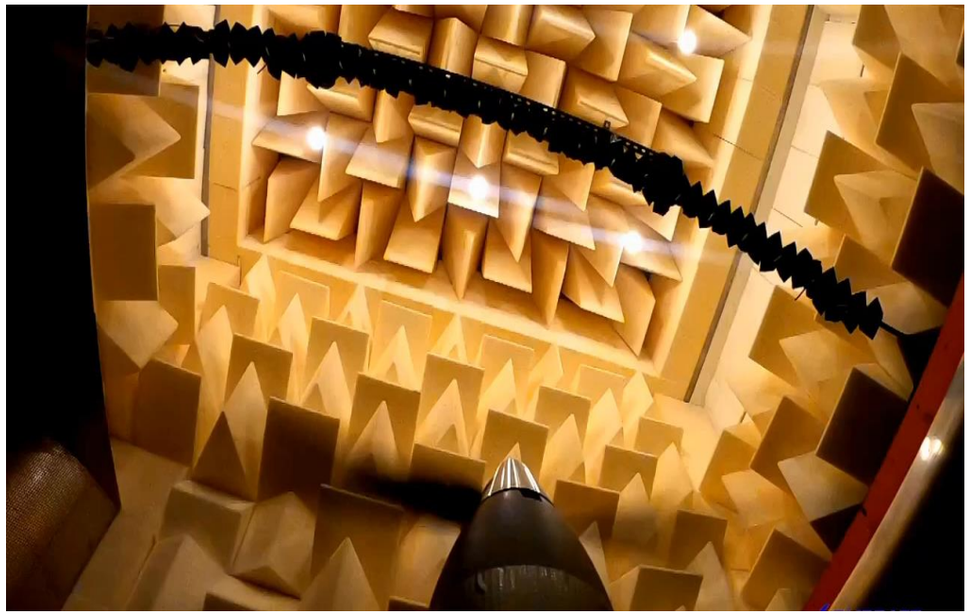
Pressure-neutral Acoustic Wind Tunnel

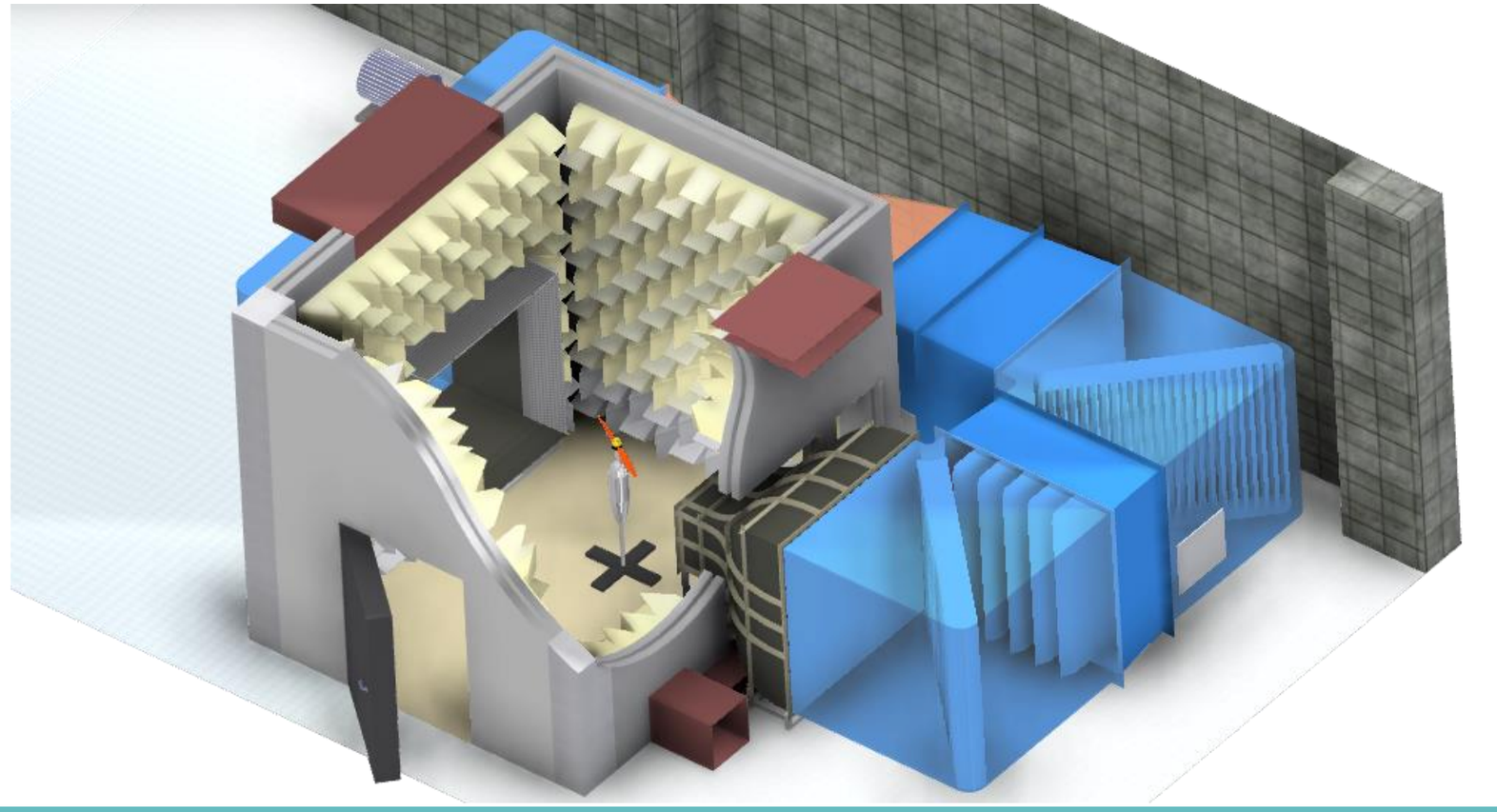
Specifications:

- Commissioned in 2021
- Nozzle exit of 1m x 0.7m
- Floor suction unit to be installed in 2026
- Max speed of 30 m/s (will be increased to 45 m/s)
- Anechoic down to 160 Hz
- Free-stream turbulence intensity (~0.1%)

Applications

- Propellers and rotors
- Aerofoils and high lift devices
- Wall-bounded turbulence
- Wall bounded turbulence





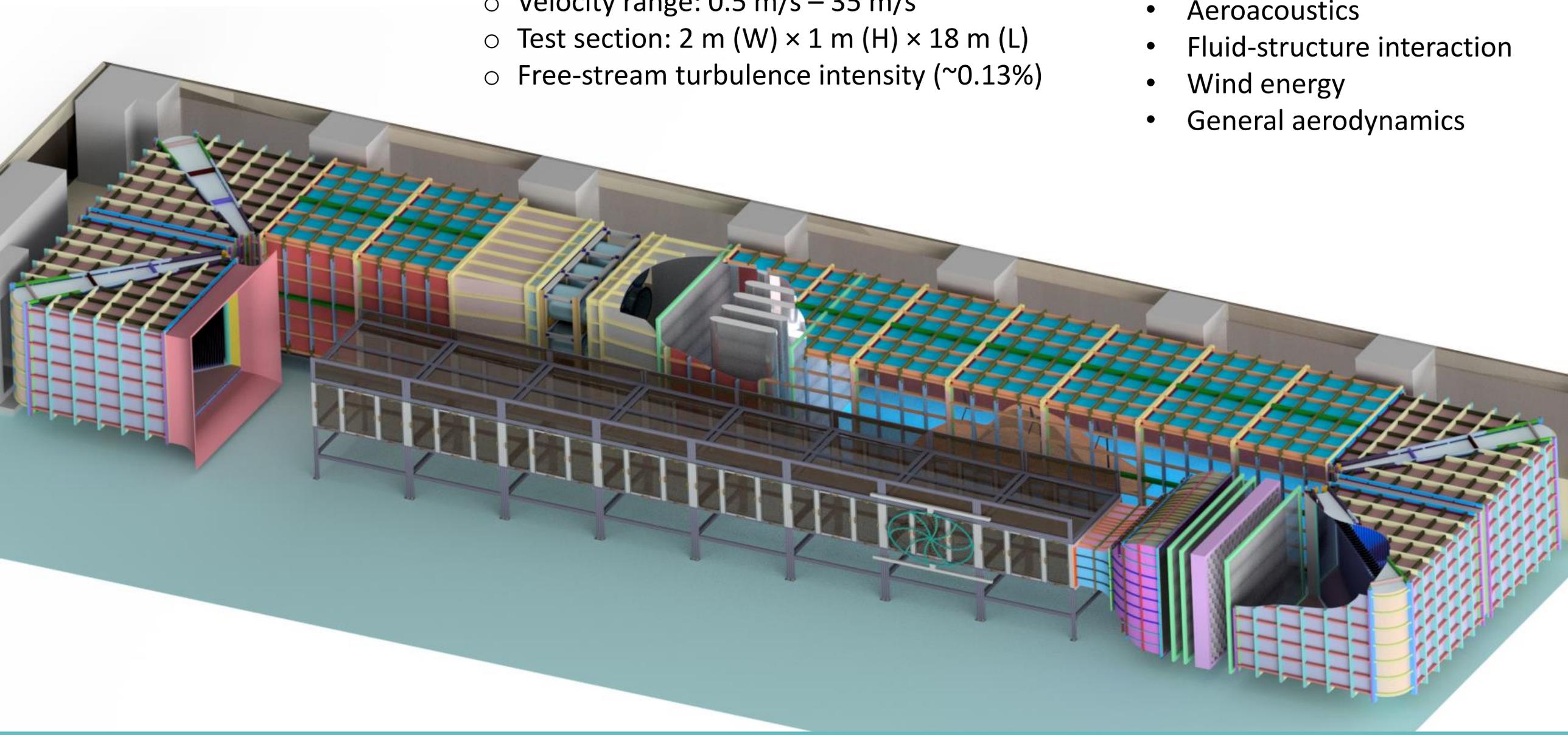
Boundary Layer Wind Tunnel

Specifications:

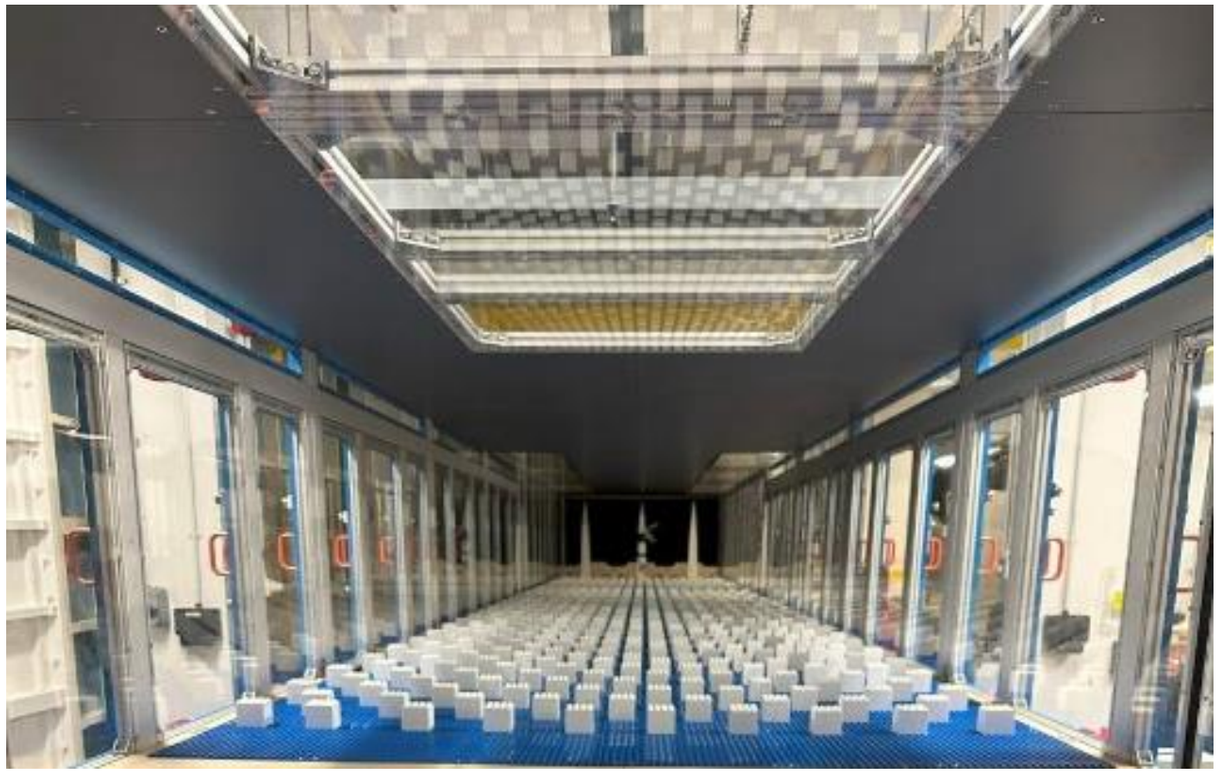
- Total Length: 30 m
- 9 axial fans, 240 kW power requirement
- Velocity range: 0.5 m/s – 35 m/s
- Test section: 2 m (W) × 1 m (H) × 18 m (L)
- Free-stream turbulence intensity (~0.13%)

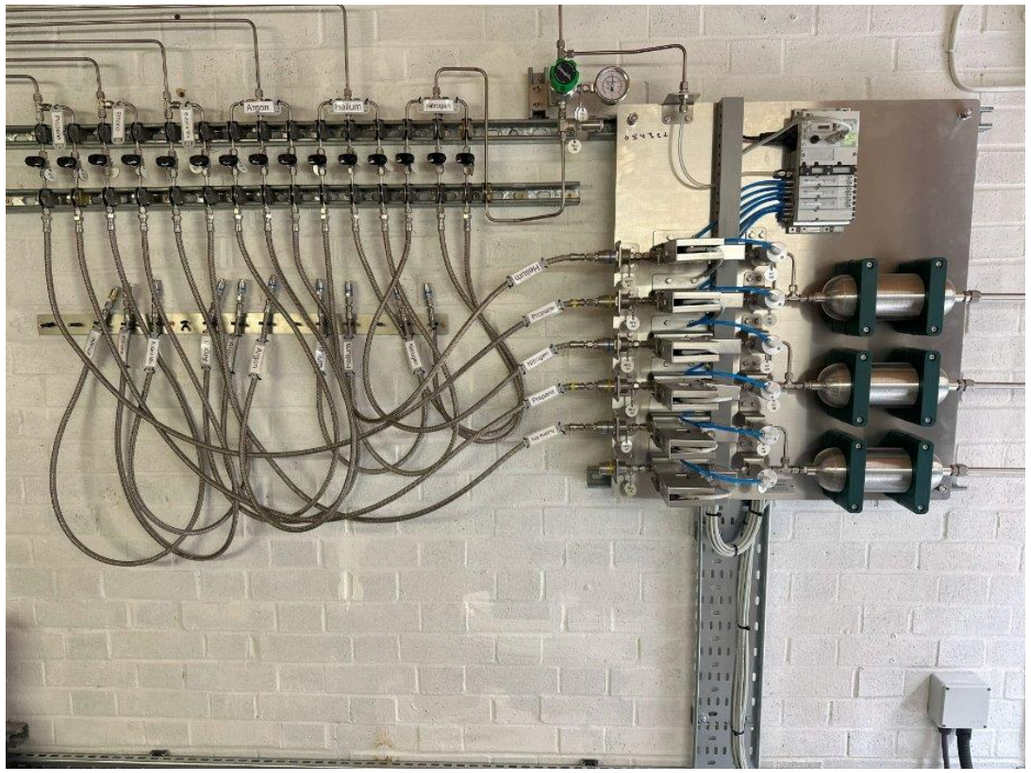
Applications

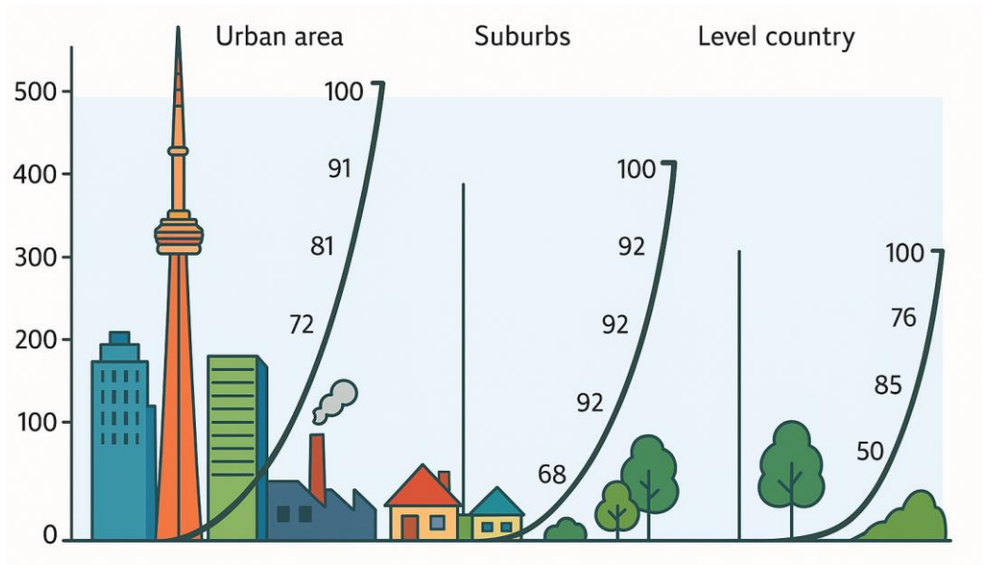
- Boundary layer studies
- Environmental aerodynamics
- Aeroacoustics
- Fluid-structure interaction
- Wind energy
- General aerodynamics

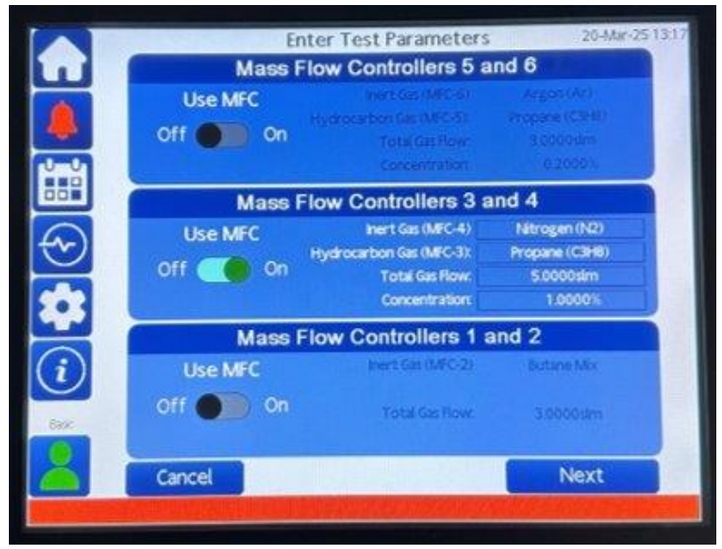


Boundary Layer Wind Tunnel









National propeller testbed

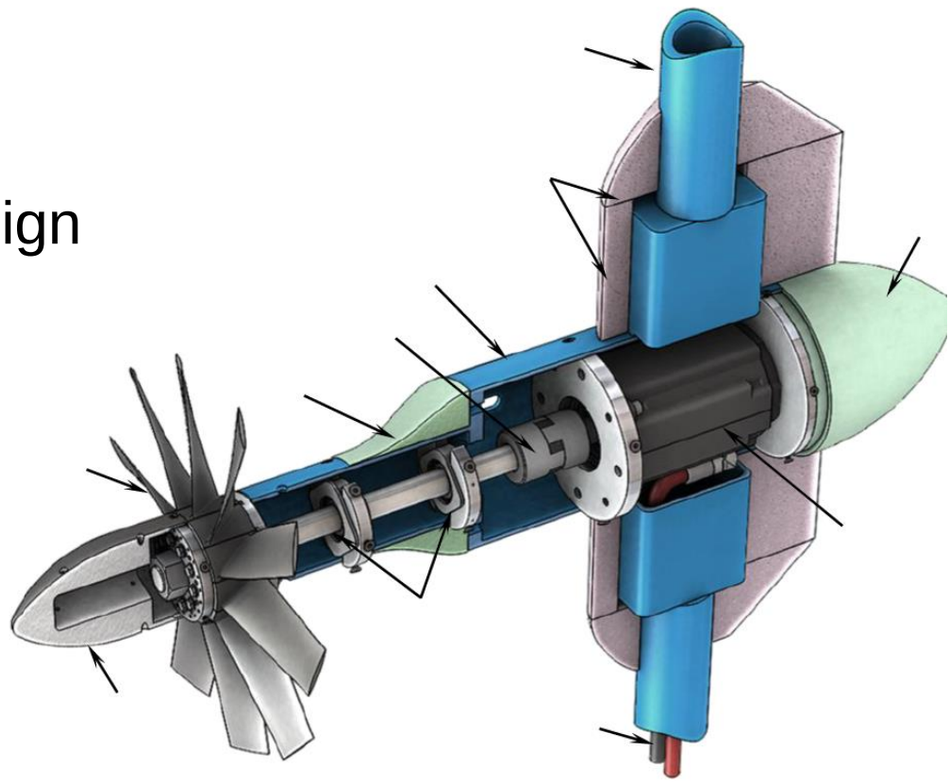
Objectives:

1 – Design and build a propeller test rig, suitable for academic and industrial research

2 – Preserve and enhance UK-based expertise in the design of such test rigs, instrumentation, and related technologies,

3 – Expand the UK's presence in research related to propulsion, instrumentation, and other related fields

4 – Help increase research income/output in this area



Virginia tech propeller test rig

Summary

The University of Bristol hosts several multi-purpose wind tunnel facilities

A strong academic and technician team is formed around the facilities

The facilities are well equipped

The facilities are currently used for several EPSRC, IUK, ATI, EU and industrial project, with overall value of over £12M

The facilities have been extensively used by external users for academic and commercial activities

NWTF