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University of Southampton Anechoic Wind Tunnel – Capabilities, Current Work and Future Plans

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National Wind Tunnel Facility (NWTF 2023)

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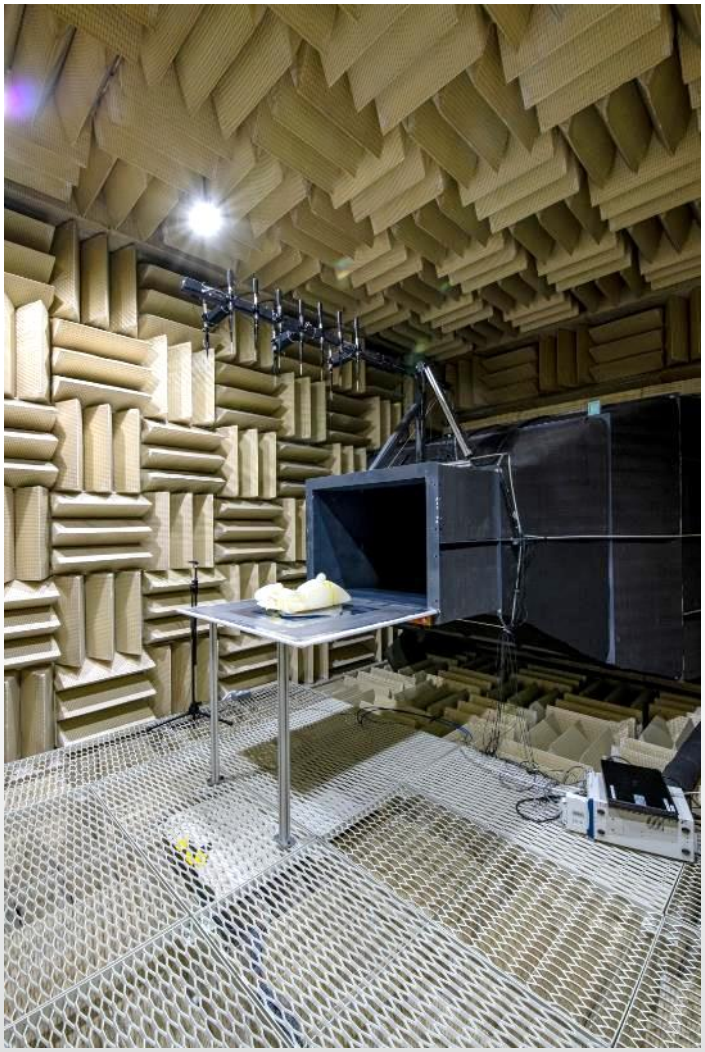

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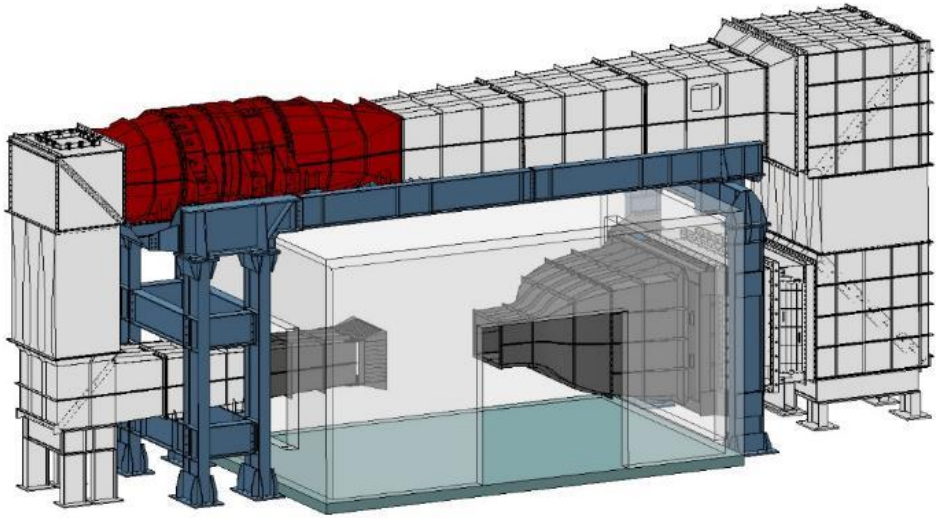
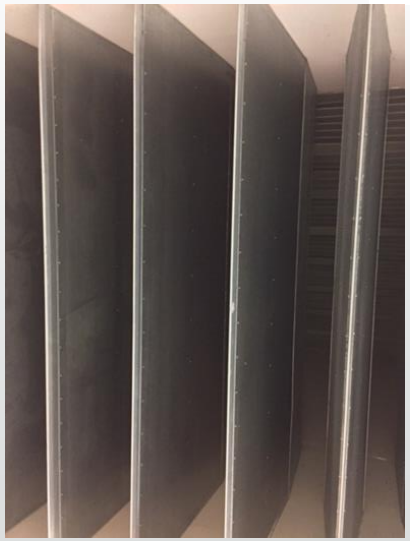
Capabilities

Capabilities

- Closed circuit wind tunnel
- Open test section within anechoic chamber
- Test section 1.0 m × 0.75 m
- Test velocity ~80 m/s (M = 0.23)

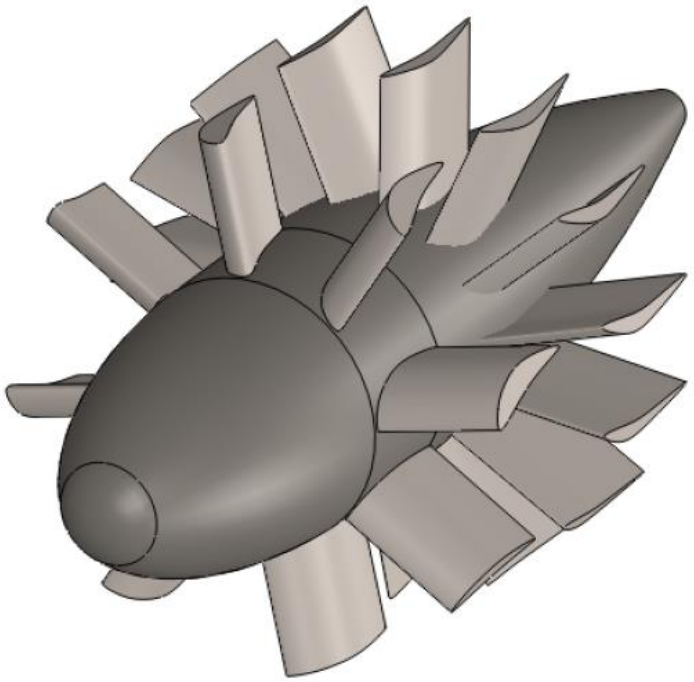




3 sections of ducted silencers to minimise transmitted noise along the wind tunnel

Specification

Parameter	Value
Mach Number	0.23
Test Section Size	1.0 m × 0.75 m
Reynolds Number per metre	5.4×10^6/m
Dynamic Pressure	3.9 kN/m²
Contraction Ratio	8:1
Turbulence intensity	0.15% at 78 m/s
Run Time	Continuous
Out of Flow Background Noise	85 dBA*



* The out of flow background noise is measured at 2.3 m from the jet centreline at an angle of 60 deg. at 80 m/s.

Anechoic Chamber

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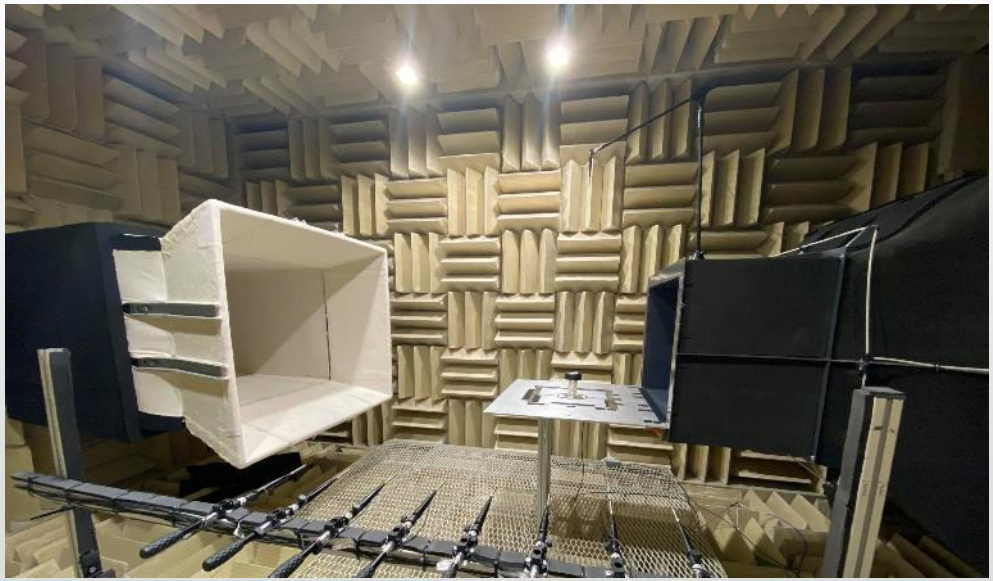
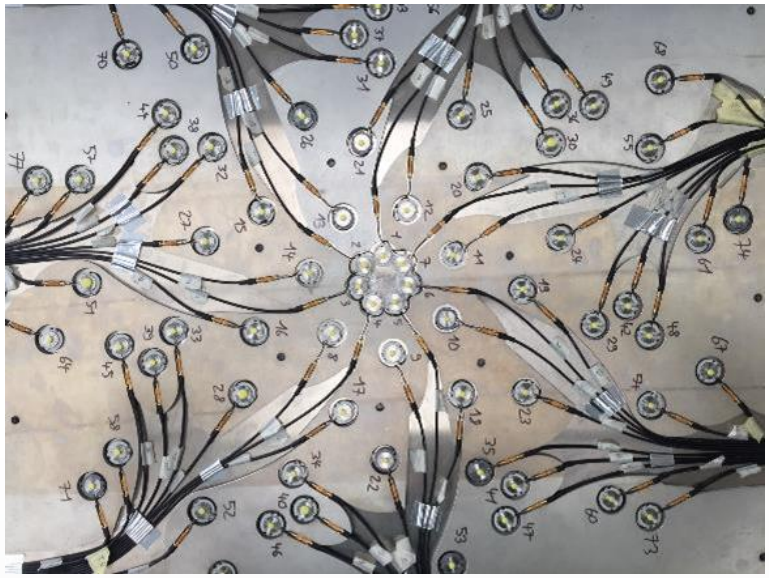
- Chamber wall thickness of 250 mm of reinforced concrete
- Size 8.1 m × 5.1 m × 4.3 m
- The chamber is isolated from the building floor slab via acoustic isolation pads
- Wedges create an anechoic environment to a nominal frequency of 250 Hz
- Acoustic panelling to minimise reflections from wind tunnel steel ducting



Instrumentation

- ATI load cells
- GRAS freefield and flush mounted microphones
- Phased microphone arrays
- Hotwire anemometry
- Kulite pressure transducers
- ZOC pressure scanner
- National Instruments acquisition



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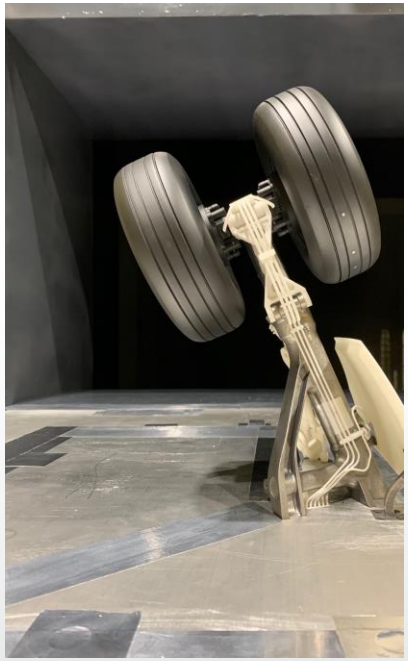
Current Work

Examples of Work

- Facility is used for commercial work, undergraduate and postgraduate research, and industrial and publicly funded research.
- Commercial work
  - Airbus (airframe noise measurements)
  - Metrological anemometers
  - UAV rotors
  - Air-to-air refuelling rigs
  - Motorsport (sidecar motorbike racing)
- Main use is in airframe and aero-engine research.

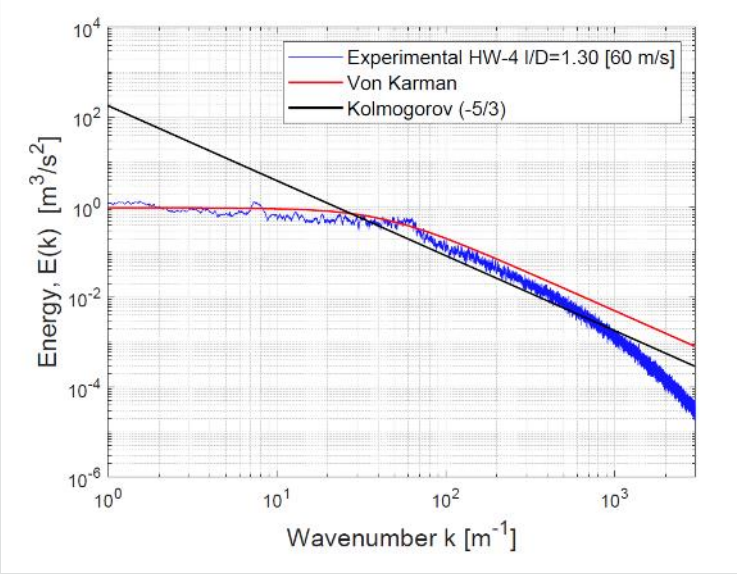
FLG2 (Innovate UK)

- Perform small-scale experiments using a scale landing gear model to generate an experimental databases to be used for numerical validation
- Interested in quantifying the ability to capture deltas between configurations and not just absolute values
- Fixture of aerodynamic and acoustic data
- Loads, Kulites, farfield noise



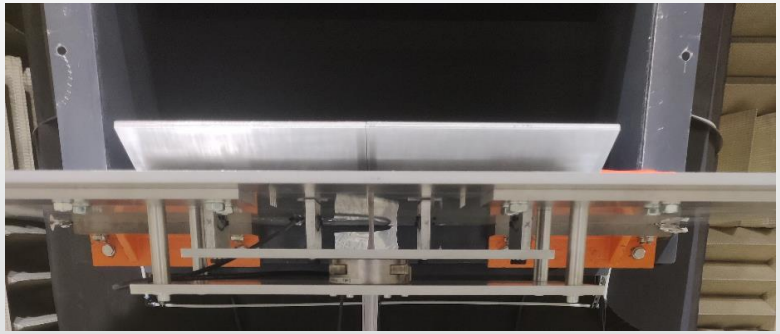
ARTEM (EU H2020)

- Investigate and down select various noise reduction technologies for installation noise reduction
- Investigate the use of mesh fairings to reduce landing gear wake flap interaction
- Investigated the effect of porosity and streamwise location
- Farfield microphones and hotwire anemometry



INVENTOR (EU H2020)

- Spoiler noise experiments
- Simple flat plate for numerical validation and fundamental understanding
- Aerodynamic measurements: Loads, on-surface pressures, boundary layer rake profiles, hotwire anemometry
- Acoustic measurements: Farfield microphones and phased microphone array



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Future Plans

Future Plans

- Particle Image Velocimetry
  - LaVision three component PIV system
  - Allow further flowfield measurements

- Kevlar test section
  - Existing collector a balance between reducing pressure loss and minimising noise
  - For lifting bodies the jet is deflected significantly
  - Kevlar test section will allow more lifting geometries to be measured

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