About the NWTF

Jonathan Morrison
Imperial College

IMPERIAL

The UK National Wind Tunnel Facility

2025 Conference
April 2-3, 2025

Jonathan Morrison
Department of Aeronautics
Imperial College

NWTF

UKRI Engineering and Physical Sciences Research Council

UK National Wind Tunnel Facility

NWTF

- A network of 23 talent-focused facilities distributed across 13 universities
- Hub and node structure
- 5-year national review
- Node is an internationally leading group
- Multi-sectoral research, low TRL (<3) but with aerospace focus
- Full range of Reynolds and Mach numbers
- Open access for up to 25% of time
- Universities are
  - ✓ *Clearly committed to wind tunnels*
  - ✓ *Research intensive*
  - ✓ *Prepared to demonstrate best practice*

University of Birmingham

Loughborough University

University of Liverpool

The University of Manchester

University of Glasgow

University of Oxford

University of Cambridge

Cranfield University

Imperial College London

University of Bristol

University of Surrey

City University London

University of Southampton

Where we are

NWTF

NWTF Current Facilities

NWTF wind tunnels have been running EPSRC, BBSRC, STFC, NERC, Innovate, ATI, UKSA, ESA, EOARD funded projects.

Location: Wind Tunnel (applications, highlights)

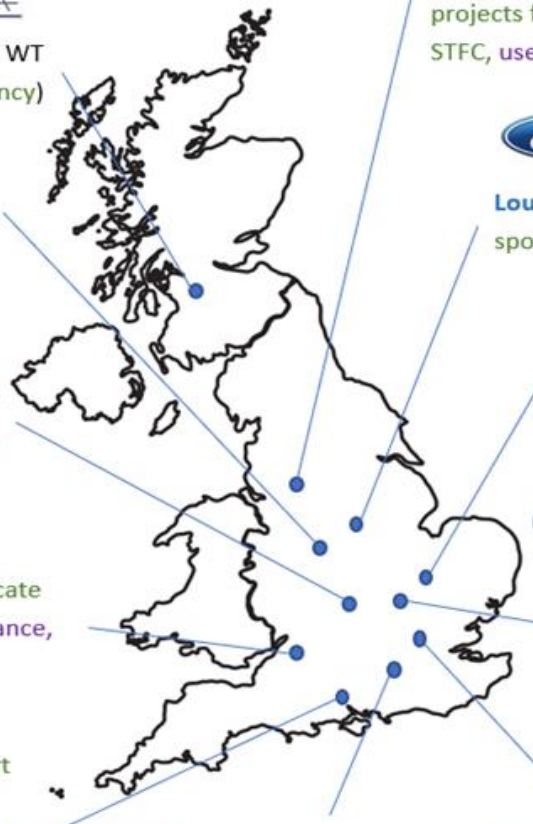
Glasgow: de Havilland Low Speed WT (rotorcraft research and aircraft efficiency)

Birmingham: Atmospheric Boundary Layer WT (wind safety) and TRAIN rig WT (crucial for vehicle aerodynamic investigations, users from Japan)

Oxford: T6 Piston Reflected Shock WT (defence, Europe's highest speed WT), High density WT (93% usage level, users from ESA and UKSA)

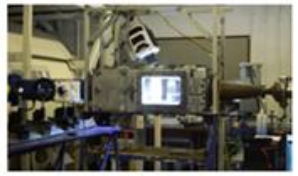
Bristol: Aeroacoustic WT (replicate flight conditions, users from France, Germany and Australia)

Southampton: R. J. Mitchell WT (motorsport research
Anechoic WT (high speed trains research), Towing Tank WT (energy, transportation, ship design, one of the largest in Europe)

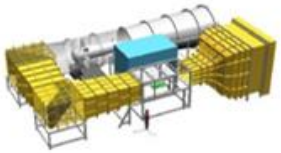


Surrey: Environmental Flow WT (world leader in climate change research, wind farms, air quality, users from Norway, Sweden and France)

Manchester: Hypersonic WT (aerospace research, projects funded by EPSRC, ESA, BAE, Newton Fund, STFC, users from Malaysia)



Loughborough: Automotive WT (industry sponsored research on automobile design)



Cambridge: Supersonic/Transonic 1&2 WT (aeronautical applications, CLEANsky project to reduce CO_2 and gas emissions

Cranfield: 8ft x 6ft Low Speed WT (automotive, aircraft design), Icing WT (aviation, environmental,

London (City and Imperial): Transonic/Supersonic WT (aerospace), 10ft x 5ft Low Speed WT (aerodynamic safety of vehicles and buildings, 90% usage level Supersonic WT (aerospace), Low Turbulence WT (aviation)

Current Awards

NWTF

Network grants (£1 m)

- Hub support (Imperial)
- Experimental database (Loughborough)
- Started April 1, 2023 (3 years)
- 13 Universities

Infrastructure Award (£23 m)

Green economic growth and human mobility

- Announced June 19, 2023
- Start date July 1, 2024 (six years)
- 11 new facilities at seven universities (one new)
- Transformational equipment at six universities
- Additional Hub support

Core equipment budget - recurrent (annual)

- Repairs / upgrades

UKRI invests £72 million upgrading UK research infrastructure

19 June 2023

UK Research and Innovation (UKRI) has today announced a £72 million investment in new infrastructure projects.

The funding will provide world-class facilities and equipment to help maintain the UK's position as a science superpower in line with the ambitions set out in the government's Science and Technology Framework.

Funding includes:

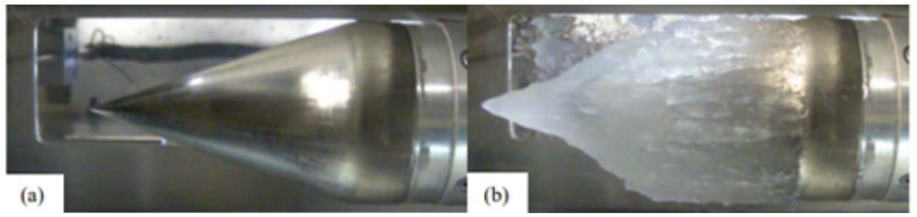
- £23 million for 11 individual wind tunnels, an experimental database and upgrades to existing facilities across the UK's National Wind Tunnel Facility network

UKRI Engineering and Physical Sciences Research Council

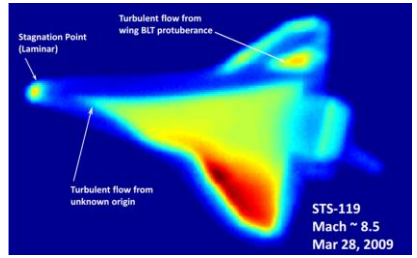
New Facilities

NWTF

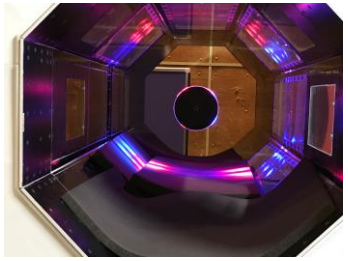
RIM: Southampton



Altitude Icing: Oxford

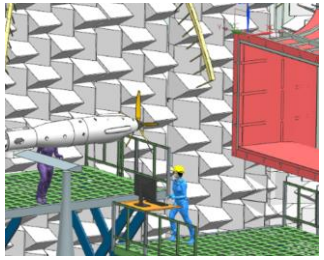


Hypersonic Quiet: Oxford

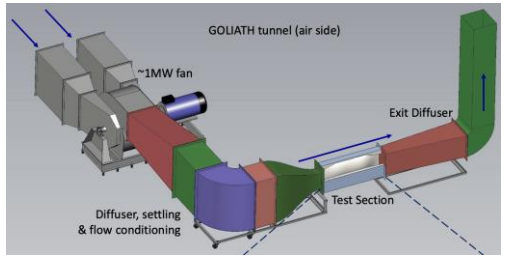


MSBS: Imperial & Oxford

Human-Flow: Manchester

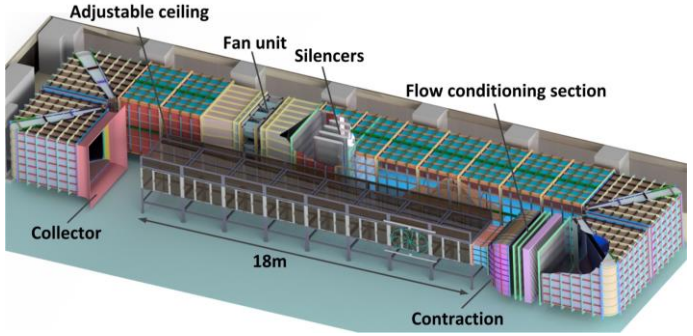


NPT: Bristol

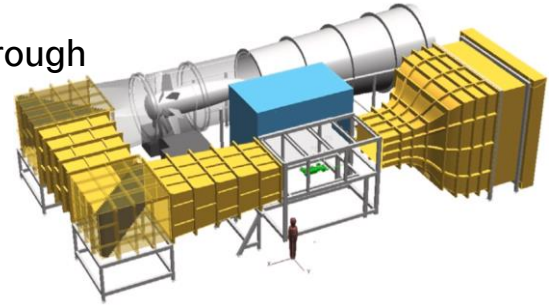


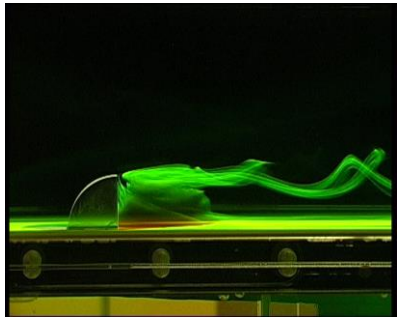
LH2: Oxford

ADAS Loughborough



AR Collar: Bristol





Laminar Flow: Liverpool

Pressure-Neutral: Bristol

Imperial College London

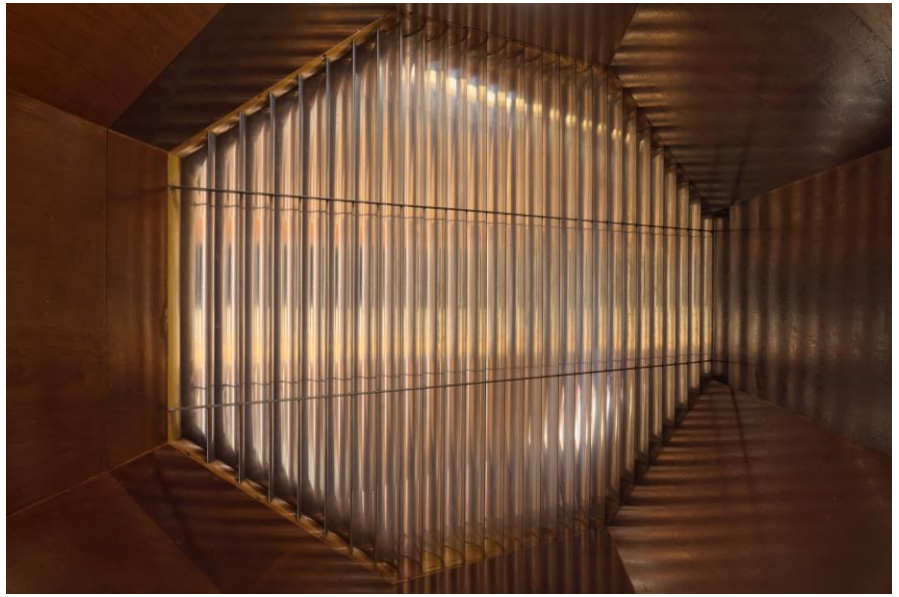
UKRI Engineering and Physical Sciences Research Council

The Status Quo

Successes:

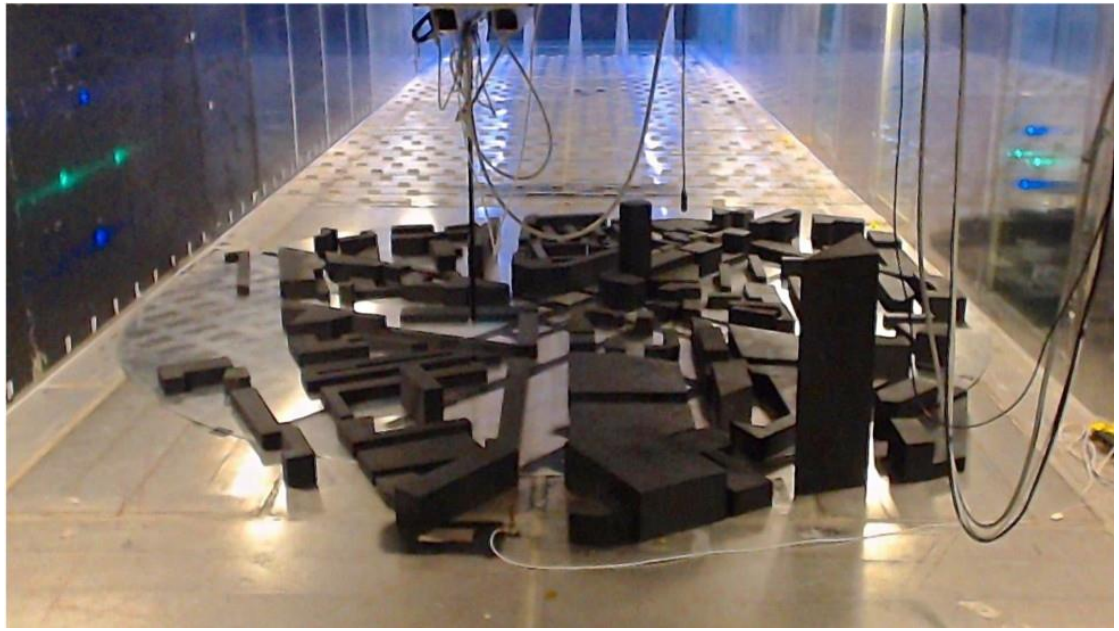
The NWTF hub and node model ‘works’

- ✓National visibility established
- ✓Capital investment
- ✓Most NWTF facilities are successful (viable) in their own right
- ✓Hub is financially sustainable – fees and grants
- ✓Hub coordinates initiatives
- ✓Hub initiates high-level contacts – a central point of contact for government & industry involvement
- ✓Workshops have begun to demonstrate how a tunnel can act as a focal point of expertise – inclusiveness
- ✓Subgroups develop new ideas
- ✓Biennial NWTF conference



Where are the opportunities?

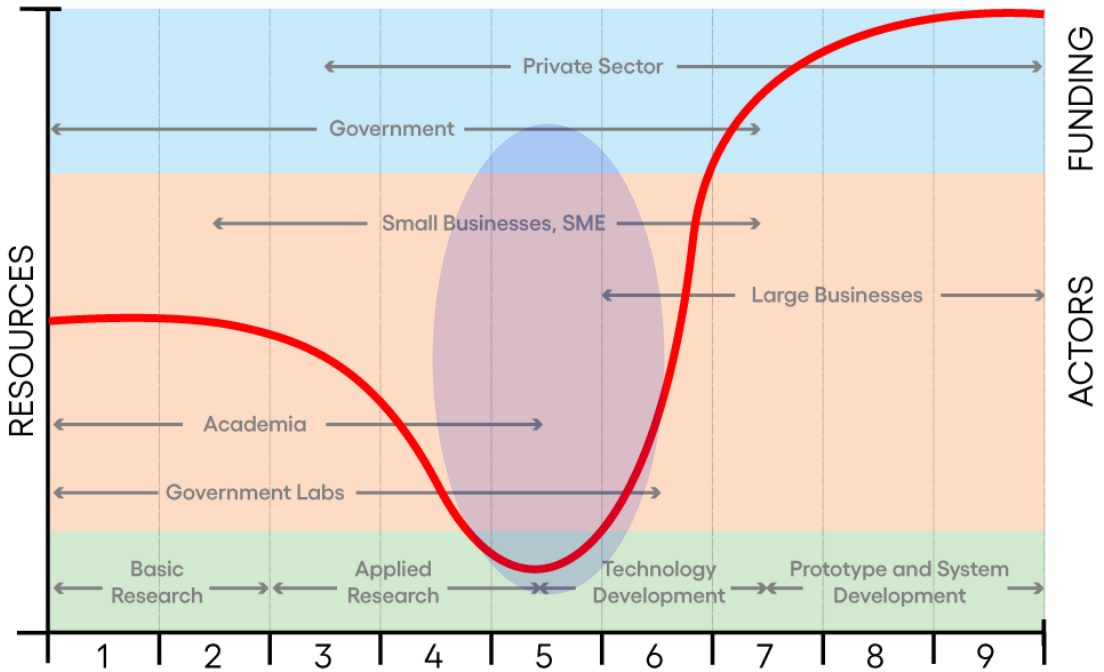
- Green (economic) growth and future of mobility
- Innovation in experiments
- Industry and TRL5+ facilities
- Data – digital threads
- Hypersonics
- Training – extending the skills base
- Cross-sectoral facilities
- Cross-overs between sectors



The Impact Gap

Challenges:

- Improving engagement - building relations with other bodies:
  - Industry
  - ATI (and Hydrogen Capability Network)
  - Jet Zero Council
  - DBT, DSIT (UKRI, EPSRC, IUK)
- Pull-though to higher TRL (5+) – bridging the “impact gap”
- Need for ECR funding – technology development enabling pull-through to higher TRL



Source: Hensen, Jan & Loonen, Roel & Archontiki, Maria & Kanellis, Michalis. (2015). Using building simulation for moving innovations across the “Valley of Death.” REHVA Journal. 52. 58-62.

Conclusions