

Transonic and Supersonic Wind Tunnels

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Shock/Boundary-Layer Interactions

- Mach number between 1.2 and 3.5
- Test section has a rectangular cross section (1290mm length, 114mm width)
- Pressurised facility allows testing at flight Reynolds numbers
- Fundamental research on canonically 2D shock/boundary-layer interactions
- Interchangeable blocks allow for quick changes in experimental setup

Normal shock



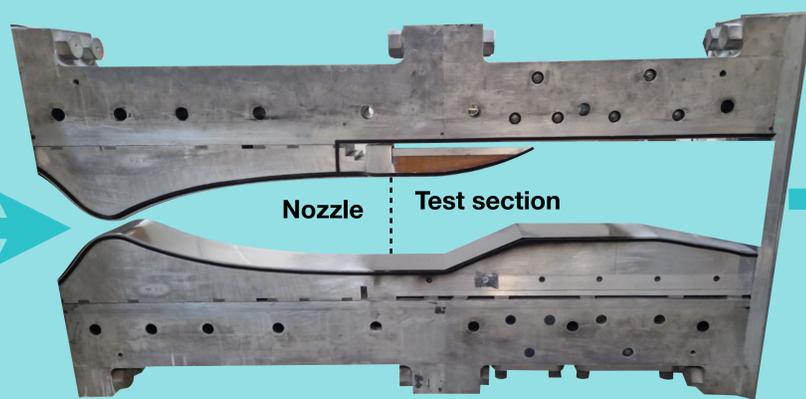
Compression corner



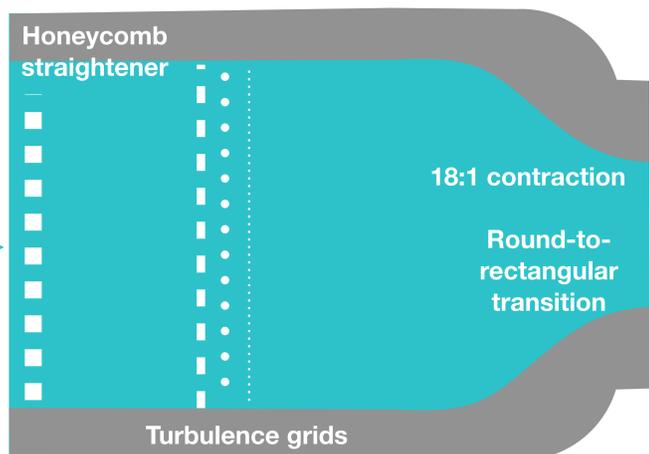
Oblique shock reflection



Supersonic test section

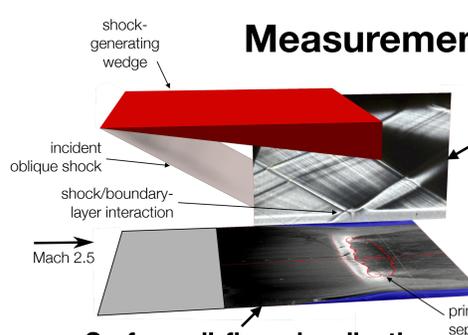


Settling chamber



High-pressure dry air

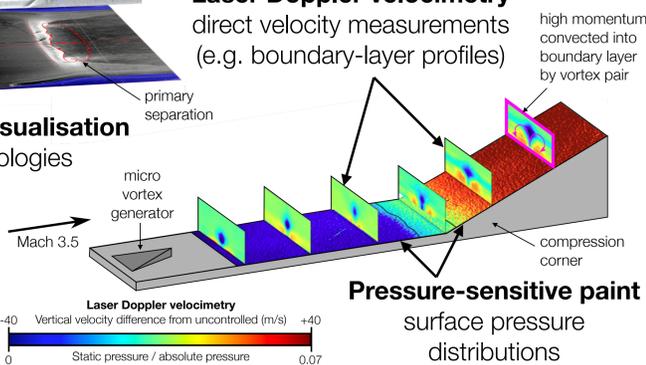
Measurement techniques



High-speed schlieren imaging
spanwise-integrated visualisation of density gradients

Laser Doppler velocimetry
direct velocity measurements (e.g. boundary-layer profiles)

Surface oil-flow visualisation
separation topologies

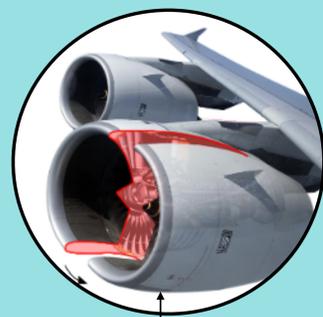


Other techniques used:

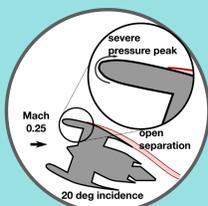
- **Infrared thermography** (transition detection from surface temperatures)
- **Surface-mounted Kulites** (unsteady pressures)

Exhaust to ambient

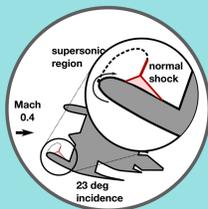
Transonic Aircraft Engine Nacelle Aerodynamics



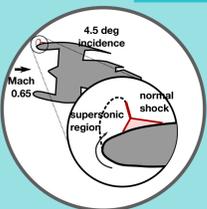
Nacelle / fan cowl around engine of long-range civil aircraft



Engine windmilling during climb out
(diffusion-driven external separation)



High-incidence take-off climb out
(shock-induced internal separation)

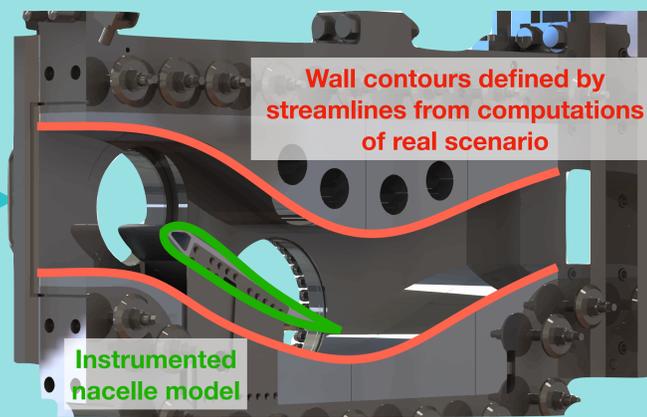


Engine windmilling during cruise
(shock-induced external separation)

Study effects of:

- Entry Mach number
- Nacelle geometry
- Nacelle incidence angle
- Engine mass-flow rate
- Reynolds number

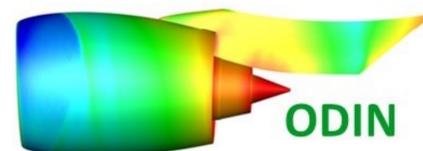
Transonic test section



Wall contours defined by streamlines from computations of real scenario

Instrumented nacelle model

Industrial & Academic Partners



Off-Design Installed Nacelles