NWTF
NATIONAL WIND TUNNEL FACILITY

High SuperSonic Tunnel (HSST)

University of Manchester

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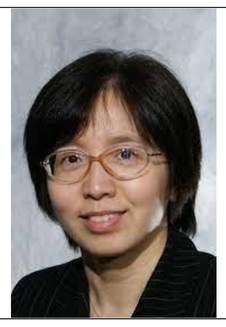

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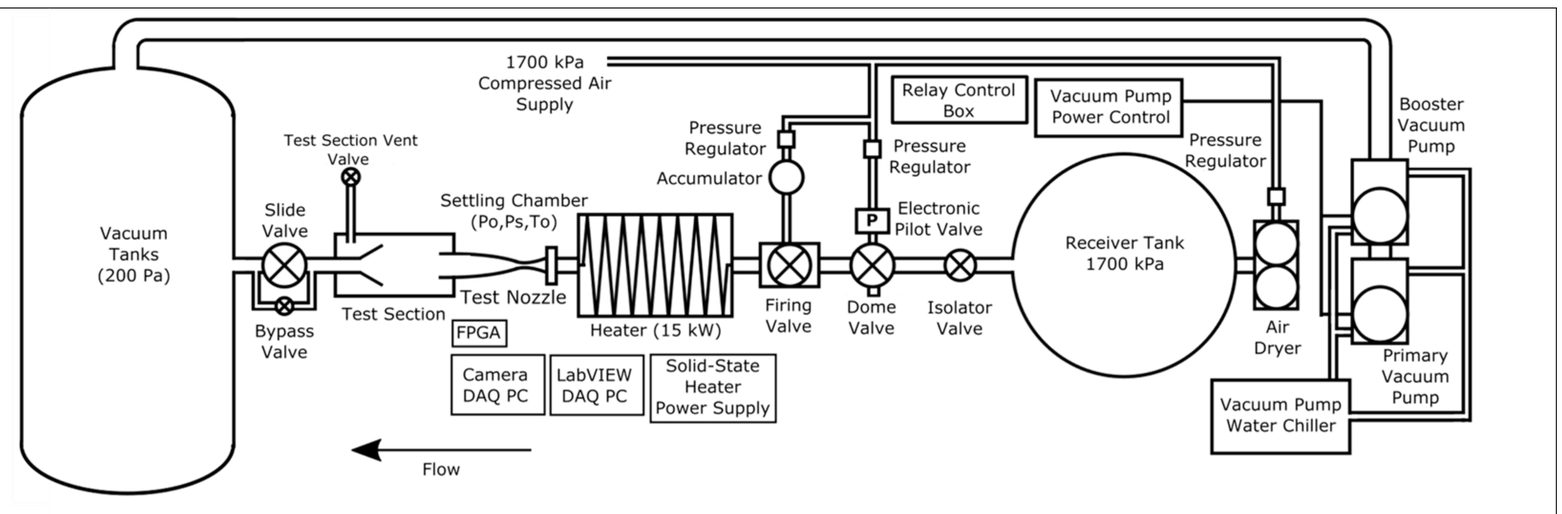
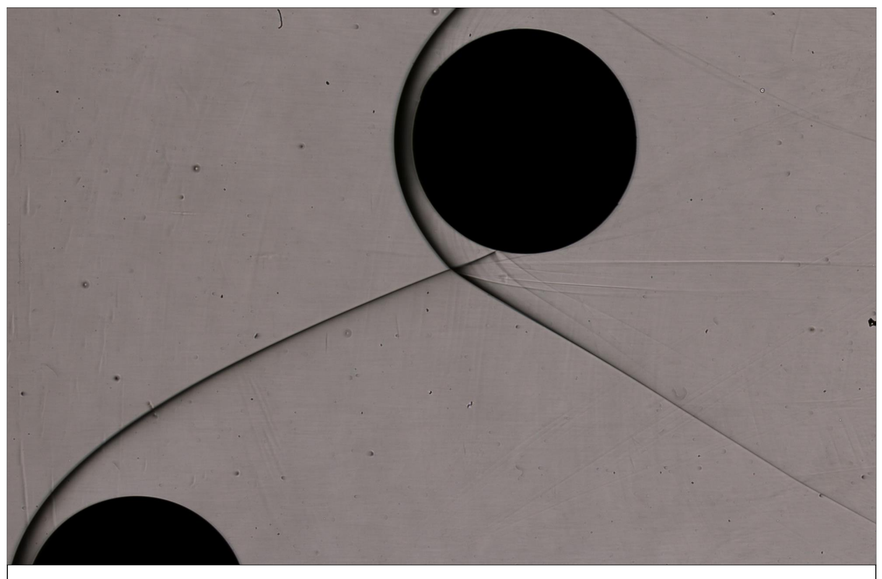
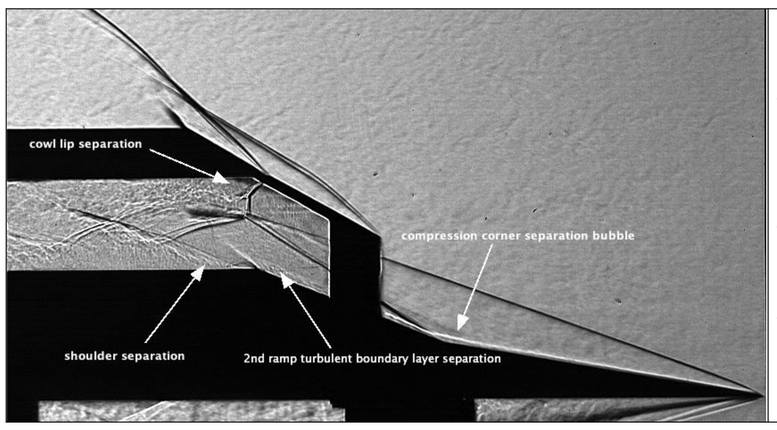




- Long duration facility (7 seconds)
- Mach 4, 5, and 6 nozzles (expandable)
- Total temperature up to 950K

- 150mm diameter test jet
- Full and half models
- Good surrounding plenum space

- Max Reynolds number ~12 M/m
- Good optical access
- Fast recharge time ~10 minutes

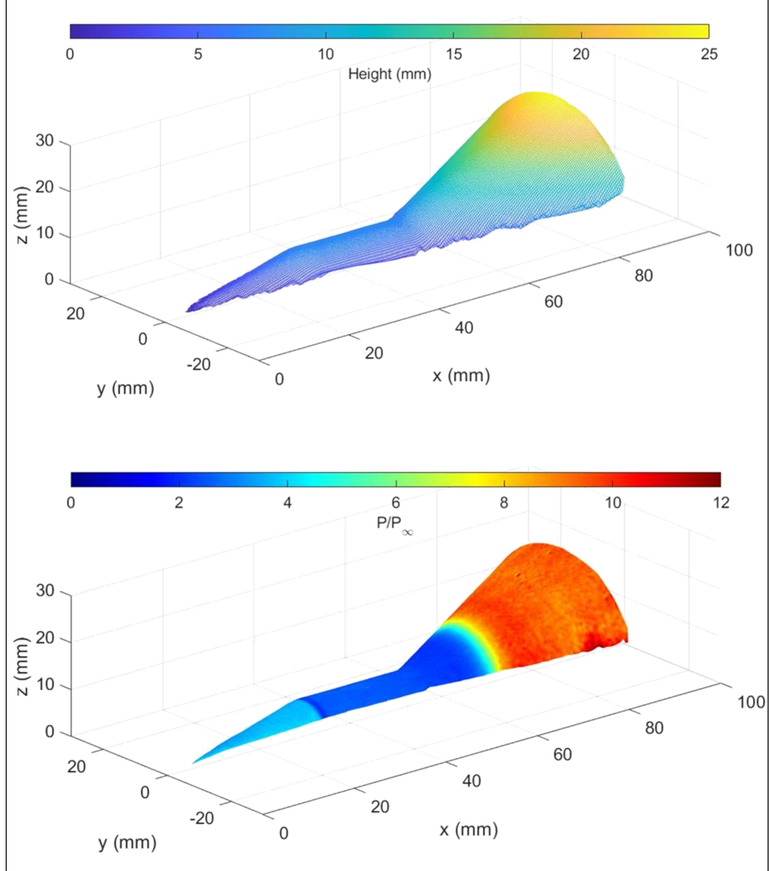


Compression Intake Testing

- Measuring performance and shock interactions of ram compression intakes is key to unlocking the potential of high-speed airbreathing flight.
- Research is ongoing on testing control mechanisms for preventing and mitigating intake unstart.
- Fundamental investigations of flow physics and also passive and active flow control are performed in this facility

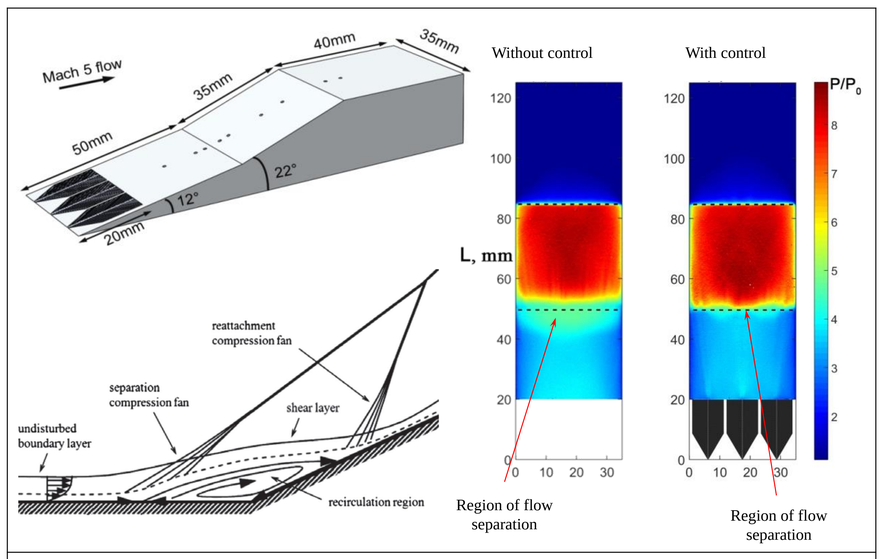
Free Flight Drop Testing

- Magnetic release of models allowing them to free fall through the flow.
- Models can also be mounted elsewhere in the test section to provide known conditions produced by another body or parent vehicle.
- Unsteady measurements and object tracking to enable characterisation of shock surfing and separation of proximal bodies in flight, including trajectory and attitude characterisation.



Optical Measurement Technique Development

- Multiple optical field measurement techniques are developed and implemented in the HSST facility.
- Schlieren imaging – steady state and high-speed schlieren imaging using either pulsed LED light sources or high-power arc lamps.
- Digital image correlation (DIC) – a method of optically computing the surface shape of the model under investigation.
- Pressure-sensitive paint (PSP) – a method of measuring surface pressure over a whole model using cameras. This technique has been applied to unsteady measurements and combined with DIC to measure surface shape and pressure.
- Infra-red thermography – measurements of surface temperature and heat transfer through germanium windows to the wind tunnel test section.
- Particle image velocimetry (PIV) – field measurements of fluid velocity using solid alumina nano-particles seeded into the test section.



Control of SWBLI

- Shockwave-boundary layer interactions (SWBLI) could result in severe unsteady loads, engine unstart, and a loss of aerodynamic performance.
- Bio-inspired micro-scale surface patterns were applied to a double ramp model.
- Patterns were shown to be capable of suppressing shock-induced flow separation occurring at the first corner.

Industrial & Academic Partners

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