



**W i n d   T u n n e l   D i v i s i o n**

# **CEPRA19**

## **Large-scale Anechoic Wind Tunnel**

**Saclay**

**Jet noise measurement capabilities  
High quality acoustic & flow measurements  
High levels of customer service**

## Cepra19 large-scale anechoic wind tunnel

Noise research facility with an open-jet test section  
Fan and heated flows jet noise testing

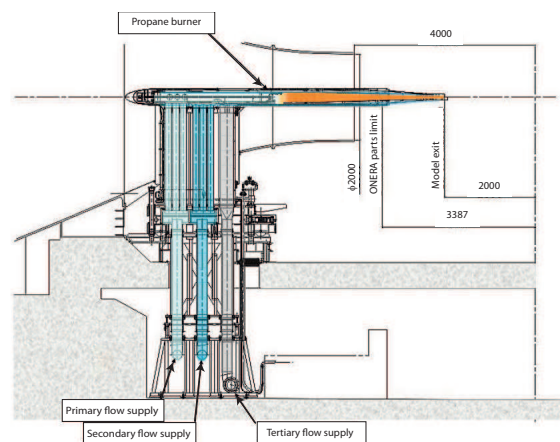
2m convergent: flight stream Mach number up to 0.38  
3m convergent: flight stream Mach number up to 0.18

### Capabilities

- **Open-circuit, open section, anechoic wind tunnel**
  - Fixed contraction (inlet diameter = 9m, two exit diameters: 3m or 2m) providing two ranges of maximum flow speed (60 m/s or 130 m/s),
  - 9.6 m radius anechoic chamber (quarter sphere),
  - Acoustically treated flow collector,
  - Diffuser,
  - Fan silencer,
  - Centrifugal fan (7 MW drive system).
- **Facility features for testing**
  - High quality continuous air flow,
  - Very good anechoicity (minimized noise reflection) & low background noise in the 200 Hz to 80 kHz frequency bandwidth,
  - Compressed air supplied with two networks up to 12 kg/sec at 5 bar.

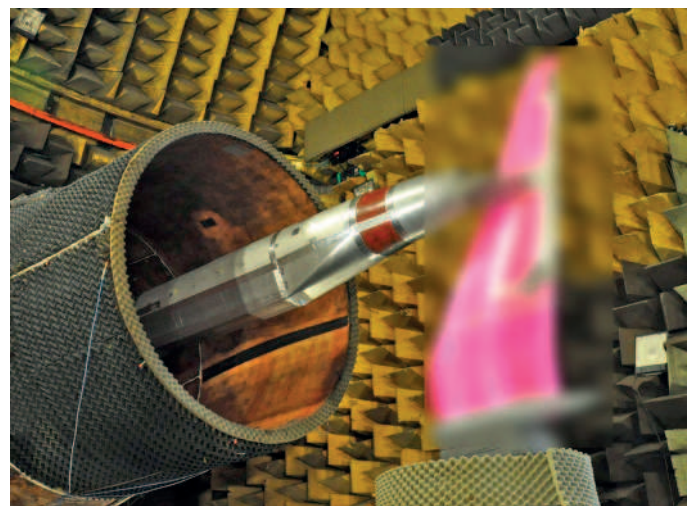
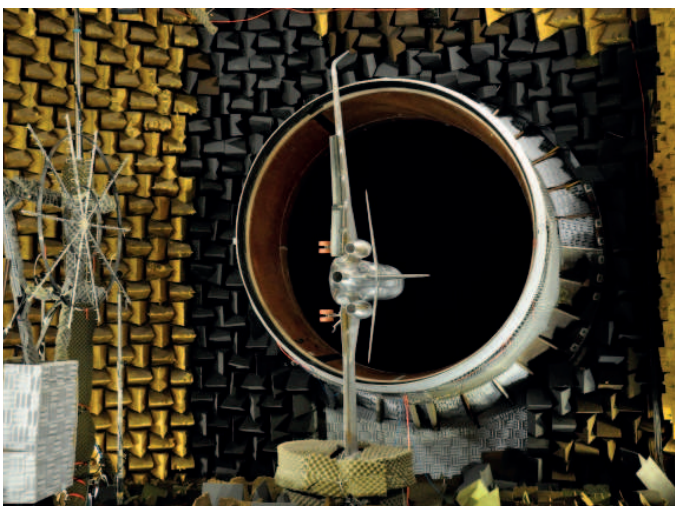
### Model support examples

- Nozzle models with bypass duct diameter up to 265 mm are installed on nozzle rig,
- Aircraft or wing models are installed on a dedicated movable table. It can be remotely translated in the horizontal plane and allows rotations up to 15°,
- Instrumentation (PIV set-up, acoustic antenna, flow survey device, ...) can be installed on a dedicated 3-axis remotely controlled tables.



### Typical tests

- Jet noise (hot or cold) with both isolated and installed configurations:
  - Single or dual nozzle model, tested with a continuous mass-flow up to 12 kg/sec,
  - Nozzle primary airflow temperature up to 1150 K, supplied by a 2 MW propane burner,
  - Nozzle secondary airflow temperature up to 450 K (resulting from compression alone),
- Airframe noise (High lift devices, landing gear, ...),
- Fan noise using TPS with both isolated and installed configurations,
- Noise reduction using microjet simulator,
- Industrial aeroacoustics issues.





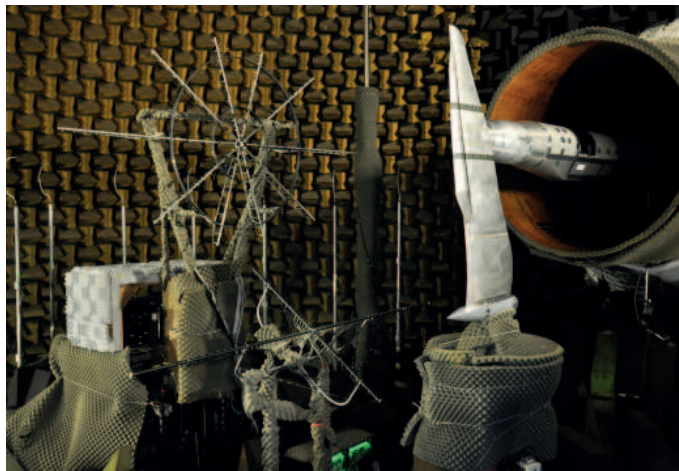
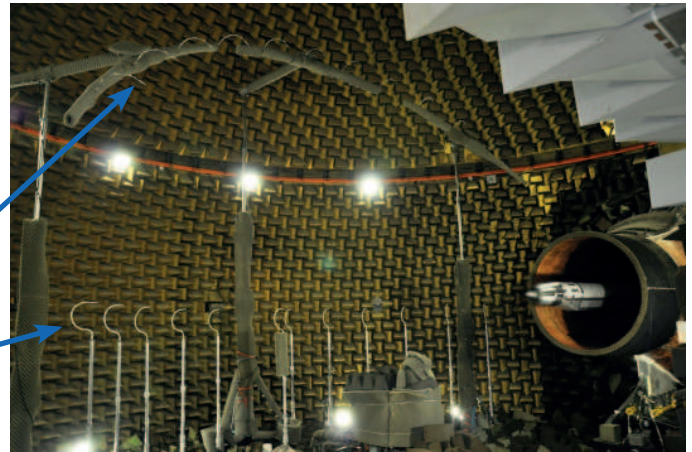
## Measurement Techniques

- **Acoustic measurements**

- **Far-field microphones**

Two 6m radius arcs, fitted with 12 microphones each (measurement range up to 80 kHz):

- Sideline arc in a longitudinal plane inclined of  $56^\circ$  over the flyover arc plane,
    - Flyover arc in the horizontal plane crossing the jet axis.

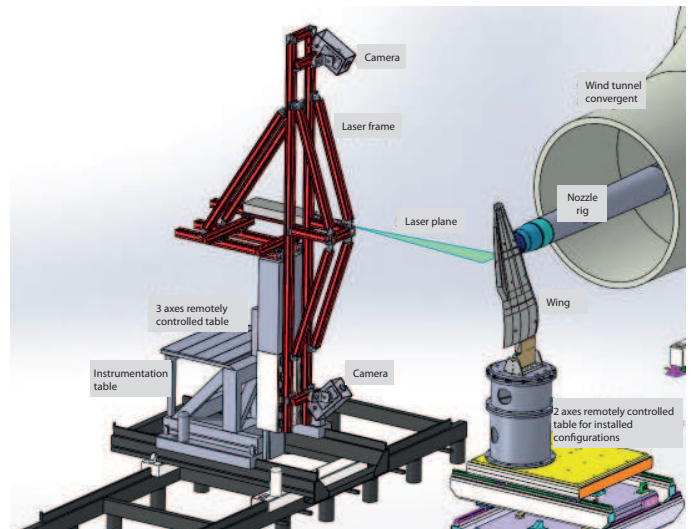


- **Acoustic antenna**

- Linear antenna (in flow), to determine the source distribution in a jet plume,
    - 2D antenna to obtain the source locations (either airframe or jet noise).

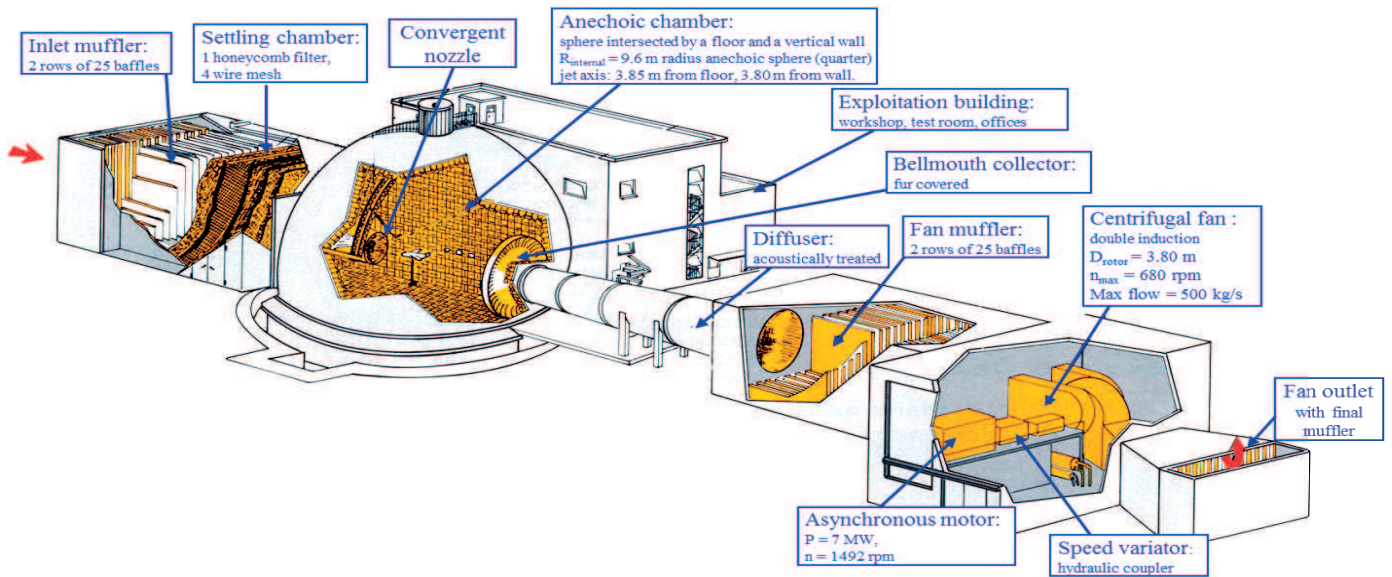
- **Aerodynamic measurements**

- Flow survey using probes (5-hole, pressure, temperature probes),
  - 3-component PIV measurements:
    - Longitudinal planes parallel to the jet axis, up to 3 m downstream the nozzle exhaust,
    - Transverse planes to cover the distribution of acoustic noise source in a jet plume.



## Data acquisition and processing

- Test data are delivered real-time to the client representatives,
- Narrow band and 1/3 rd octave analysis,
- Dynamic bandwidth up to 80 kHz,
- Continuous monitoring for nozzle operating conditions and flight stream,
- Pressure acquisition with PSI® multi-sensors,
- Acoustic data corrected from wind tunnel background noise, convection-refraction and atmospheric absorption,
- Model deformation correction for installed configuration.



## Quality Management

- Our Quality Management system is certified to be ISO 9001 compliant,
- High level of customer service,
- The ONERA wind tunnel division is committed to deliver the best service and value for money to its customers. Test matrices can be customised during the test itself, to maximise value to the customer.

## Quality in measurement techniques

- New capabilities are being introduced as part of our continual improvement strategy.

## Confidentiality

- Secure test preparation and testing sites with card access, data & computer firewalls.



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