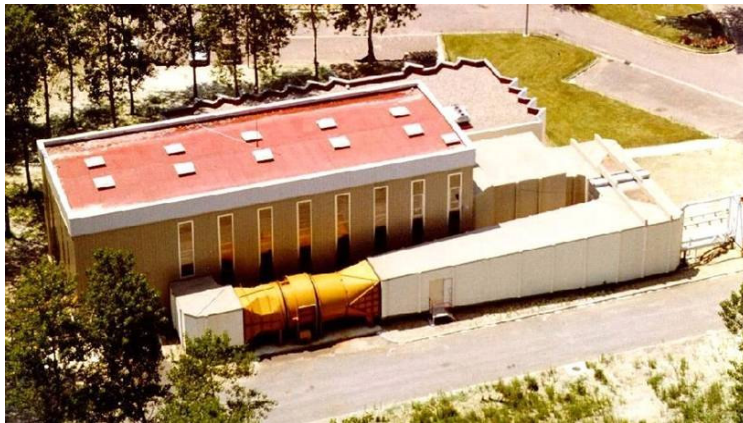


## F2 wind tunnel

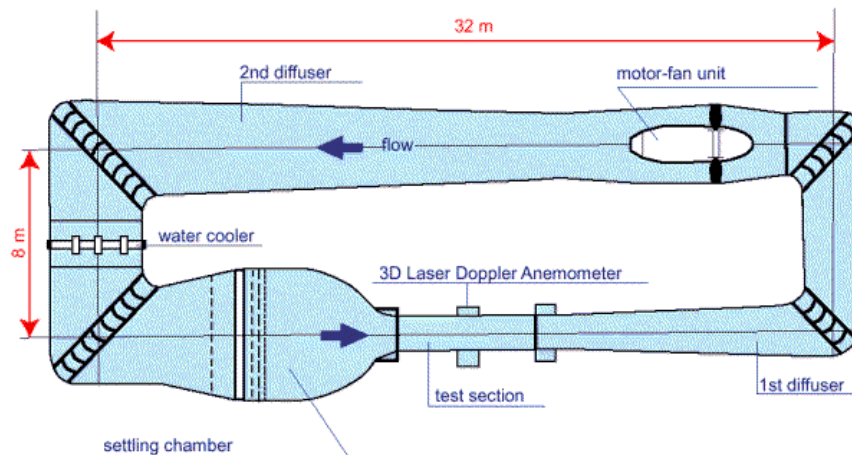
***Subsonic Wind Tunnel, Low turbulence, Research Facility,  
Laser Doppler Anemometry***

***The F2 subsonic continuous flow wind tunnel is a research facility  
allowing the use of large size models.***



*F2 wind tunnel bulding*

- Test section dimensions:
  - length: 5 m,
  - width: 1.4 m,
  - height: 1.8 m.



*F2 Wind Tunnel overview*

- The side walls of the test section are made up of removable opaque or transparent panels which allow viewing access to be specially adapted according to the requirements of each test.
- The wind tunnel is equipped with a 12 bladed fan driven by a 680 kW direct current motor. The velocity can be continuously varied from 0 to 100 m/s by adjusting the motor speed.
- The total temperature is controlled in  $\pm 1^\circ\text{C}$  by a water cooler.

- The settling chamber is equipped with 4 screens, a honeycomb filter, and noise dampers on walls, which, in conjunction with a contraction ratio of 12, supply a flow with a very low level of turbulence in the test section (less than 0.05 %).

## SUPPORTS

- Sting holder: pitch range: 50°.
- Wall set-ups:
  - lateral motorised turret,
  - floor motorised turret.
- 2D set-up between side walls.
- Special test set-ups can be designed and manufactured according to test requirements.



**Sting set-up**



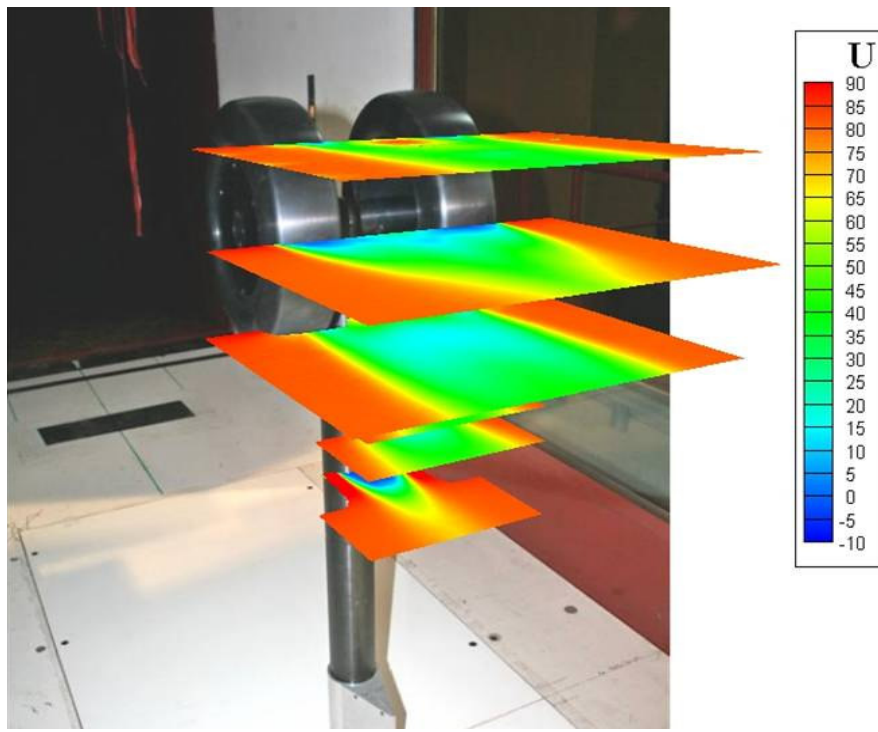
**Motorised floor turret**

## LASER DOPPLER ANEMOMETER (LDA)

- Fringe mode LDA allowing the 3 velocity components to be measured simultaneously by associating one and two-dimensional sub-assemblies.
- Numerous mechanical and optical combinations allow sets of measurement axis which meet the needs of the test (optical access to measurement point).
- Three different arrangements are available: lateral horizontal, lateral vertical and orthogonal.
- Exploration of almost the entire volume of the test section, with fully computer controlled displacement of the measurement point in a volume of:
  - $X = 0.5 \text{ m}$ ,
  - $Y = 0.6 \text{ m}$ ,
  - $Z = 1 \text{ m}$ .
- Seeding of the flow by incense smoke, generally emitted downstream of the test section.

## TECHNIQUES

- Three dimensional laser anemometry.
- PIV capability.

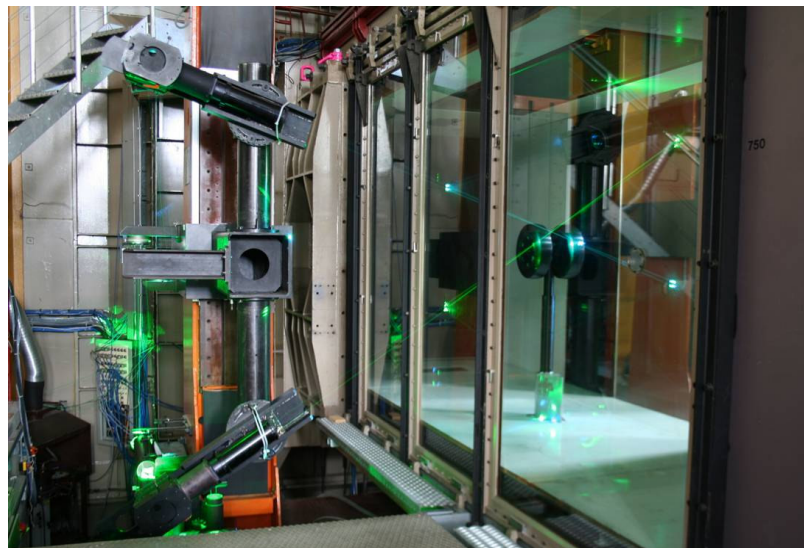


*PIV visualization*

- Flow visualisation by laser sheet.
- Visualisation by colored oils, acenaphtene sublimation kaolin, liquid crystals, infrared camera...
- Flow survey remotely controlled mechanism.

### FLOW QUALITY

- The flow quality can be rechecked as necessary:
  - on the centreline:
    - velocity distribution by a axial probe,
    - turbulence and noise measured by hot wires and microphones.
  - in the whole of the test section:
    - 3D velocity distribution by LDA.



*LDV 3D*

## TYPICAL TESTS

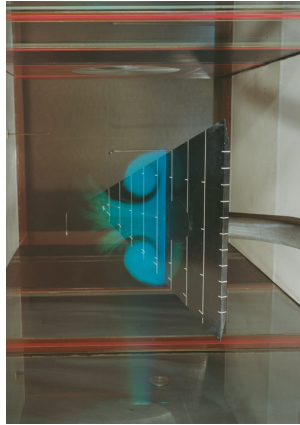
- The wind tunnel is well adapted to study complex flow phenomena (three dimensional boundary layer, separations, wakes).
- Transition surveys.
- Airfoil studies between walls.
- Probe calibration.

## MEASUREMENTS

- Steady and unsteady measurements:
  - 32 analog channels,
  - 4 hot wire channels (can be extended on request).
- 3 speed component measurements by laser anemometer.
- Real time or near instantaneous plots and results.
- Results transfer by intranet network.

## ASSISTANCE

- Assistance by ONERA specialists can be provided for aerodynamic, model design and manufacture, unsteady measurements, optics, etc.
- Preliminary calibrations and tests can be done using other ONERA rigs and wind tunnels.
- On-site assistance (mechanical design office, workshop, instrument laboratory, computers, etc.).



*Flow vizualisation by laser sheet in F2 test section*

OFFICE NATIONAL D'ETUDES ET DE RECHERCHES AEROSPATIALES

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