ONERA

S3 Modane

Blow down wind tunnel

rectangular section

from Mach 0.1 to Mach 5.5

GRANDS MOYENS TECHNIQUES

Rectangular section

maximum 0.80 m x 0.76 m

The main features

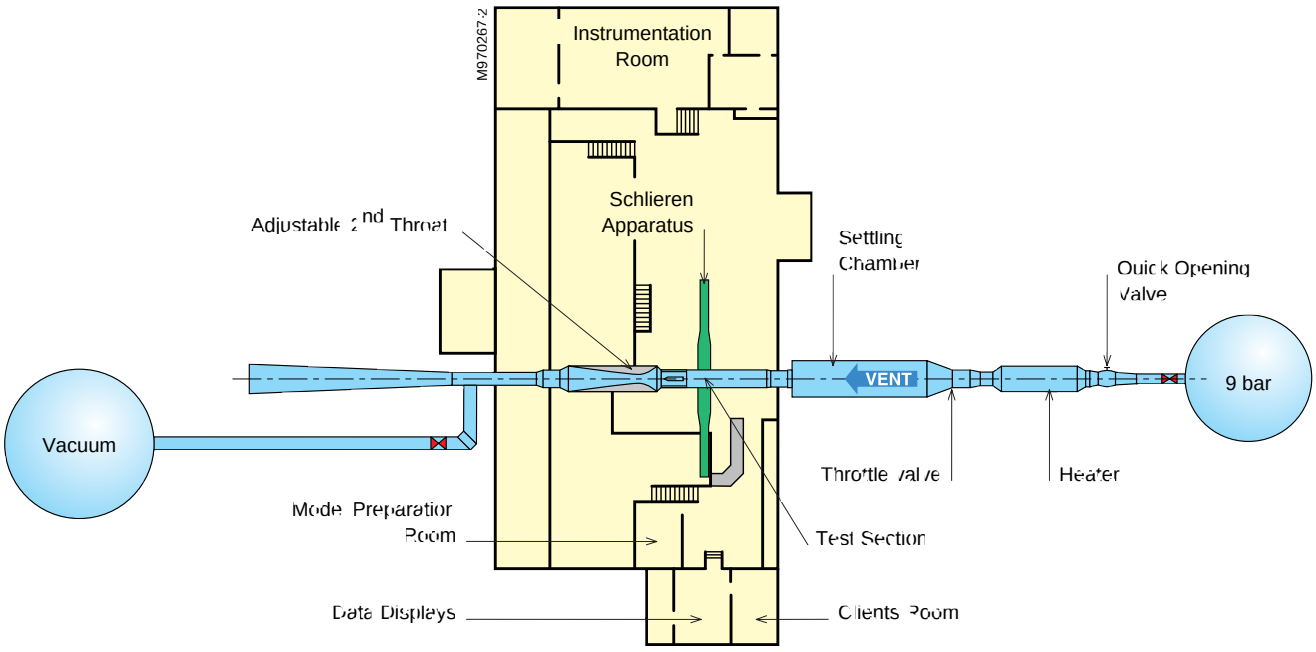
- stagnation pressure: from 0.2 bar to 7.5 bar (according to nozzle and Mach number);
- stagnation temperature by electrical storage heater: maximum 530 K;
- running time: from 10 seconds to 15 minutes according to conditions (10 to 35 seconds with exhaust at vacuum storage tanks, 1 to 15 minutes with exhaust at atmosphere) ;
- Reynolds number: maximum 54.10^6 referenced to 1 meter (according to nozzle and Mach number);
- clean airflow by 80 µm mesh filter;
- quick and easy access to model by removing the test section right wall;
- productivity: 3 to 20 runs or 20 to 40 polars per day, 15 to 50 minutes between runs.

The model supports

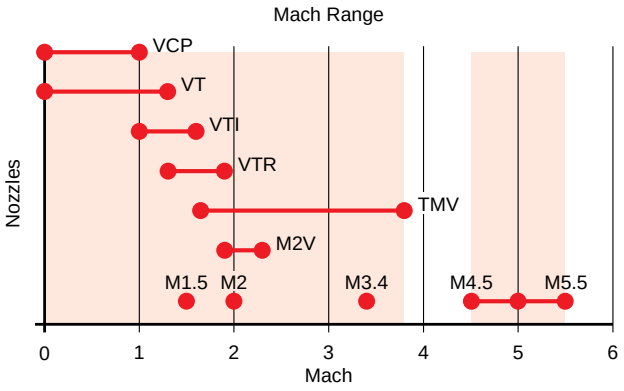
- sting holder sector strut, motorised in pitch: 24° range, pitch rate 1 or 2°/s;
- roll motorised sting: 360° range, roll rate up to 7.5°/s ;
- high angle of attack missile test rig: sting motorised in pitch up to 90°, pitch rate 3°/s;
- wall turrets, motorised in pitch: from 0° to 360°, pitch rate 3°/s;
- side wall supports;
- support struts;
- numerous ONERA stings available;
- other supports according to test needs: all types of rigs can be designed and manufactured on request;
- hydraulic jacks supports for profile pitch oscillation;
- rigs for testing models with high pressure compressed air.

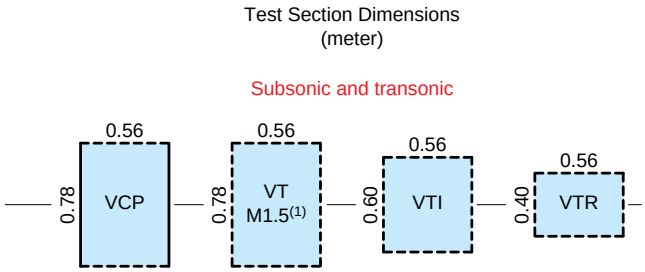
The test techniques

- data acquisition system with 48 analog channels: steady measurements rate up to 25 Hz per channel with a 14 bits + sign A/D converter;
- unsteady measurements: up to 20 kHz per channel;
- pressure measurement rate, by PSI® electro pressure scanner, can reach 1,472 mean values every 10 seconds (the average value is worked out from a sample of 127 results per channel);
- on-line data processing by DEC Alpha computer and data display on the spot in the wind tunnel (screens, editions, graphs, CD-Rom);
- movable data acquisition and processing system dedicated to model preparation away from the test section;
- ONERA 6 components balances, internally mounted (in the model)



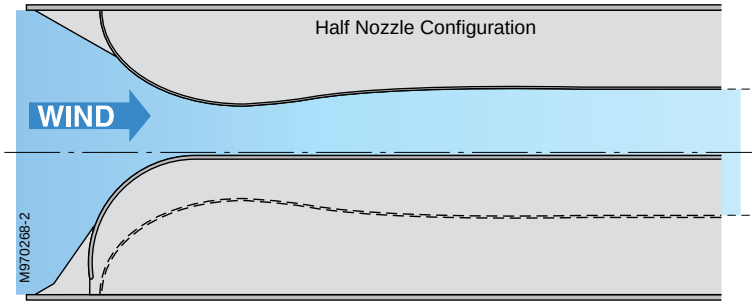
The test sections

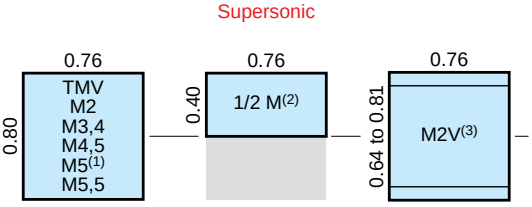




Vertical Wall Porosity = 9.7%
Horizontal Wall Porosity = 30% or 0%

(1) - Porosity 0 % for M1.5

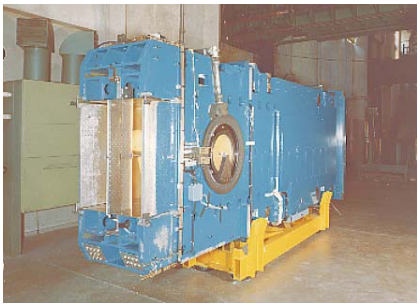




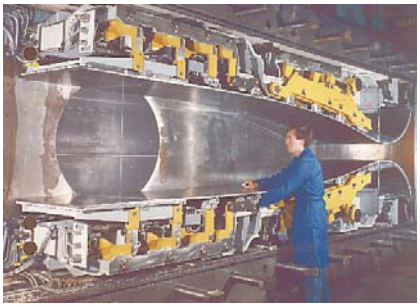
(1) - M5 by M4.5 blocks rotation.
(2) - 1/2TMV, 1/2M4.5, 1/2M5, 1/2M5.5: half nozzle with flat lower block at wind tunnel axis.
(3) - M2V: half nozzle, flat lower block.

or wall mounted; numerous balances are available and new ones manufactured on request;

- compressed air:
  - 9 bar, 9,500 m³ (maximum) storage tanks, pumped up through a 21 kg/s mass air flow compressor.
  - 270 bar, 115 m³ (maximum) storage tanks, up to 18 kg/s mass flow;
- vacuum: 0.010 bar minimum pressure, storage tanks of 8,000 m³ (maximum), sucking in air at up to 15 m³/s;
- 2D or 3D laser velocimetry (on request);
- visualization by shadowgraph (800 mm field diameter), steady or spark coloured schlieren method (800 mm field diameter), pigmented oils, acenaphtene sublimation, infrared.
- Intranet connection available to deliver tests results on a PC in client room;
- Possibility to be connected to client site by numeris and/or Internet network.

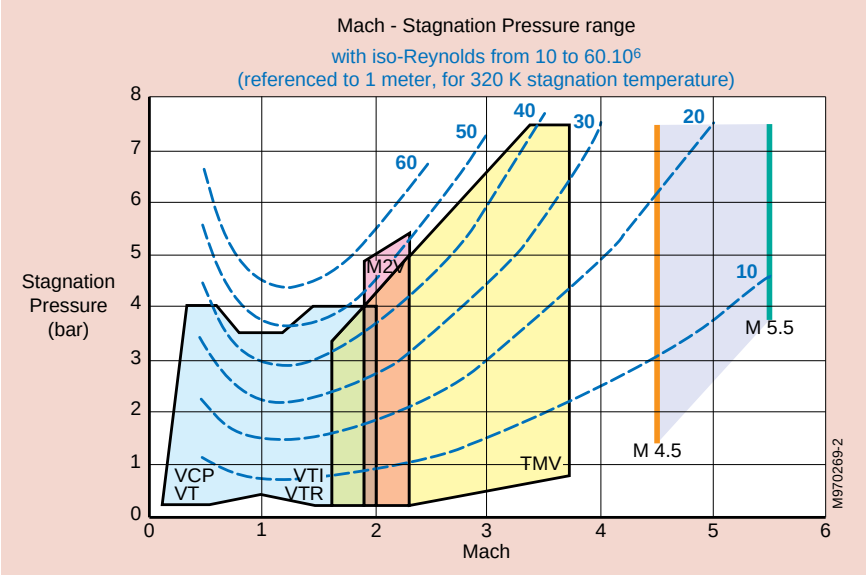


Nozzle (VCP) for two-dimensional airfoils testing (C10557).



Variable Mach supersonic nozzle (TMV) from Mach 1.65 to Mach 3.8 (M850039).

The tests range



The assistance

• assistance by ONERA specialists may be provided for aerodynamics, model design and manufacture, acoustics, unsteady system measurement, optics, etc. ;
• preliminary calibrations and tests can be done on other ONERA rigs and wind tunnels;
• on the spot assistance (mechanical design office, workshop, instrument and balance lab., model dimensions measuring shop, computers.

Warranted absolute confidentiality

Model preparation and tests in isolated and protected cells.
Numerous tests run for foreign customers.

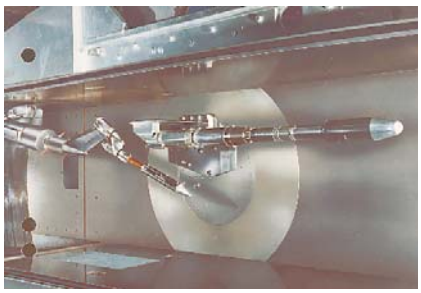
Set-up for high angle of attack missile test (C12140).

Quality Assurance

The Quality System related to engineering of test facilities, designing and performing of tests in the facility was certified in accordance with the NF EN ISO 9001 standard, by BVQI, in december 1997 (certificate n° 44635).

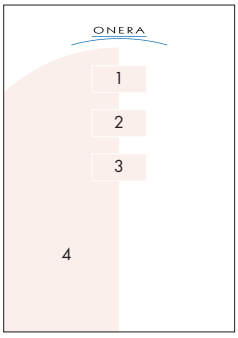
The typical tests

• force and/or pressure measures on missiles models;
• air intakes (steady and unsteady measures);
• models equipped with cold jet (compressed air) or hot jet (rocket engine);
• optronic systems;
• radome erosion by rain or sand;
• airfoil or helicopter blade aerodynamic data;
• unsteady measurements on pitch oscillating profile model;
• heat transfert measurements;
• high speed, low altitude flight conditions simulation;
• free flights of models dropped or shooted against flow.



Ariane 4 booster separating (M840138).

Coloured schlieren methode: transversal jet interaction on a control surface (M902140).



1 - General view of S3 Modane wind tunnel (M850198).
2 - Set-up for high angle of attack missile test (C12140).
3 - Ariane 4 booster separating (M840138).
4 - Variable Mach supersonic nozzle (TMV) from Mach 1.65 to Mach 3.8 (M850039).

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