



ONERA Large Reference Model in the transonic wind tunnel S1MA – Modane, France

Wind Tunnel Division



A wind tunnel for every type of test

Facility	Type Power	Test section L x H	Velocity/ Mach number	Reynolds number based on 0.1VA	Main applications Optical measurement capabilities: <i>Particle Image Velocimetry</i> <i>Pressure Sensitive Paints</i> <i>Model Deformation Measurement</i>
F1 Fauga-Mauzac	Continuous Pressurized 9.5 MW	Cart 1 4.5 x 3.5 m Cart 2/4 4.5 x 3.5 m Cart 3 4.5 x 3.5 m	$M \leq 0.36$ ≤ 123 m/s $M \leq 0.36$ 123 m/s $M \leq 0.36$ ≤ 123 m/s	$8 \cdot 10^6$ $8 \cdot 10^6$ $8 \cdot 10^6$	Model mounts: sting, 3 masts, single mast $\frac{1}{2}$ models with engine simulators Ground effects Air inlets, with or without ground effect PIV, PSP, MDM
F2 Fauga-Mauzac	Continuous Atmospheric 0.75 MW	1.4 x 1.8 m	≤ 100 m/sec	$1.1 \cdot 10^6$	Research programs Blade profile optimization for wind mills 3-D laser velocimetry with long travel (0.5 x 0.6 x 1 m) PSP
CEPRA19 Saclay (DGA EP)	Aeroacoustic Continuous Atmospheric 7 MW	Open jet \varnothing 2 m Open jet \varnothing 3 m	120 m/s 60 m/s	$1.3 \cdot 10^6$	Aeroacoustic testing with or without jet simulation PIV, PSP, MDM
S1MA Modane-Avrieux	Continuous Atmospheric 88 MW	Transonic 3 carts \varnothing 8 m	$M < 1$	$7 \cdot 10^6$	$\frac{1}{2}$ models, with engine simulators Model mounts: sting or mast Laminar flow tests Air inlets Captive trajectory system Rotating wings, rotors Aeroacoustic measurement capabilities Sting interferences determined with CFD PSP, MDM
S2MA Modane-Avrieux	Continuous pressurized 55 MW	Transonic 1.75 x 1.77 m Supersonic 1.75 x 1.93 m	$M \leq 1.5$ $1.5 \leq M \leq 3.0$	$5.4 \cdot 10^6$ $4.0 \cdot 10^6$	Model mounts: sting or wall $\frac{1}{2}$ models with engine simulators Captive trajectories/stores release Air inlets Simulation of hot or cold jets Dynamic stability PIV, PSP, MDM

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S3MA Modane-Avrieux	Blow down	0.56 x 0.78 m 0.76 x 0.80 m	0.1 ≤ M ≤ 1.3 1.65 ≤ M ≤ 3.8 + fixed nozzles M 2/3.4/4.5/5.5	3.5 10 ⁶ 3.2 10 ⁶	Launchers and missiles 2-D profiles Mounted on sting or on wall Precipitation erosion Air inlets Jet simulation PSP
S4MA Modane-Avrieux	Blow down	∅ 0.68 m ∅ 1 m ∅ 1 m	Hypersonic	0.35-1.7 10 ⁶	Load, pressure and thermal flux measurement Coating thermal and mechanical resistance tests Aerothermal erosion Air inlets and ramjets
S4B Modane-Avrieux	Model engine calibration rig	4 " bench 9 " bench	Simulated Mach ≤ 0.9		Thrust/flowrate calibration of flow-through or motorized nacelles Direct or reverse jet configuration Laser velocimetry and IR thermographic measurements
BD2 Modane-Avrieux	Dynalpy test bench for nozzle				Flow features : Primary flow: 16kg/s, T ≤ 1150 K Secondary flow: 14 kg/s, T ≤ 450 K Tertiary flow: 0.7 kg/s Thrust (13,500 N), side loads, temperatures, pressure and flowrate measurements
R4-1 Modane-Avrieux	Blow down	∅ 600 mm	M < 1		Air intake testing research programs

Quality management, Confidentiality

Quality Assurance system is certified to be ISO 9001 compliant.

Productivity / Availability

Individual preparation room for model assembly and equipment. Dedicated model carts. Productive testing. High stability in Mach number control.

Design office & work shop

In-house model design and manufacture capabilities. Internal balances: 80 balances available and new ones manufactured on request.

Quality in measurement techniques

New capabilities are permanently developed.

Carbon footprint

S1MA is a water driven wind tunnel.



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