



## Identification of the installation/facility:

Country: France  
Location (city): Saclay  
Name of the facility: PAG Icing Wind Tunnel  
Date of construction: 2007  
Owner: DGA Aero-engine testing  
Contact point: Franky Le Mézo  
Internet site: <http://www.defense.gouv.fr/dga/la-dga2/expertise-et-essais/dga-essais-propulseurs>

## Technical characteristics:

### 1 - Type of infrastructure

Wind tunnel	<input checked="" type="checkbox"/>
Propulsion bench	<input type="checkbox"/>
Structures facility	<input type="checkbox"/>
Material facility	<input type="checkbox"/>
Simulator (ex. Flight simulator, tower, ...)	<input type="checkbox"/>
Flight test bed (aircraft, embedded facilities, ...)	<input type="checkbox"/>
Supercomputers	<input type="checkbox"/>
Other	<input type="checkbox"/>

### 2 - Main technical characteristics

PAG has two standard test sections of 1 meter in length each:

- a test section 500 X 200 mm
- a test section 200 X 200 mm

The principal performances are summarized in the table below:

Test section	n°1 200 X 200 mm	n°2 200 X 500 mm	Tolerance of adjustment
Air Mass Flow Rate	2 to 10 kg/s	2 to 13 kg/s	± 0.2 kg/s
Speed (empty test section)	50 to 220 m/s	20 to 120 m/s	± 1 m/s
Mach Number (with-15°C)	0.70	0.37	-
Liquid Water Content	0.15 to 3 g/m <sup>3</sup>	0.10 to 3 g/m <sup>3</sup>	± 0.05 g/m <sup>3</sup>
Total Air Temperature	-40 to +15 °C		± 0,5 °C
Median Volume Diameter	15 to 50 µm		± 1 µm

The PAG facility lays out:

- of a transformer high voltage delivering a three-phase current 380 V (for the needs for ventilator PAG and the group of Antarctic cold),
- catches sector 230 V, 50 Hz.



The specimens under test (de-icer, probe) could be fed, according to the needs:

- in direct current:
  - by “mobile” D.C. current supplies from 0 to 40 V, 25 A
  - by a “mobile” D.C. current supply 100 V 100 A,
  - by a “mobile” D.C. current supply 80 V 11 A.
- in alternating current:
  - by the network 230 V,
  - by three-phase current 380 V, maximum power available 70 kW,
  - by a single-phase supplying 400 Hz, 115 V, 1 kW,
  - by a three-phase supplying 50 to 1000 Hz, 115 to 200 V and 4.5 kW,
  - by a three-phase supplying 50 to 750 Hz, 115 to 200 V and 9 kW.

*3 - Research domains which can be addressed (refer to ACARE taxonomy <http://www.acare4europe.com/sites/acare4europe.org/files/document/ASD-Annex-final-211004-out-asd.pdf> )*

Innovative Concepts & Scenarios - Breakthrough Technologies  
Integrated Design & Validation (methods & tools) - Flight/Ground Tests

*4 - Main (or specific) associated measurement techniques*

Standard Measurements:

The adjustment of the test conditions and the monitoring of the facility require approximately 40 measurements (pressures and temperatures mainly).

For the control and/or the follow-up of the specimens under test, the data acquisition system can acquire the following supplementary measures:

- Temperature measurements by thermoelectric thermocouples, connectors ref. OMEGA NEWPORT HMP-K-M with cable length of 2 m requested:
  - of K type: up to 36
  - of T type: up to 6 (limitation due to the number of line currently available).
- Temperature measurements by probes standard turntable RTD 100 ohms 4 wires: up to 38 supplementary measures.
- Pressure measurements: up to 33 supplementary measures (interface requested: flexible lines □□4/2,7 mm length 2 m.
- Electrical measurements, flow and speed: up to 34 supplementary measures, including 8 for measurements flow and speed.

Video:

A camera on turret allows the monitoring of the installation from the cabin. One or more video cameras can be used for the follow-up of the specimen under test (traditional camera color with 25 frames per second, to 3 screens available in cabin). When required by the customer, the video recordings are carried out numerically on recorder DV-CAM. Video service DGA EP transfers then on DVD, for the customer, the recordings on support DVD with format MPEG2.



For the transmission of the video signals, the bench is equipped with:

- 9 COAX lines including 1 used by the surveillance camera,
- 4 optical fiber lines.

*5 - Operational status*

- Fully operational in 2013

*6 - Pictures :*

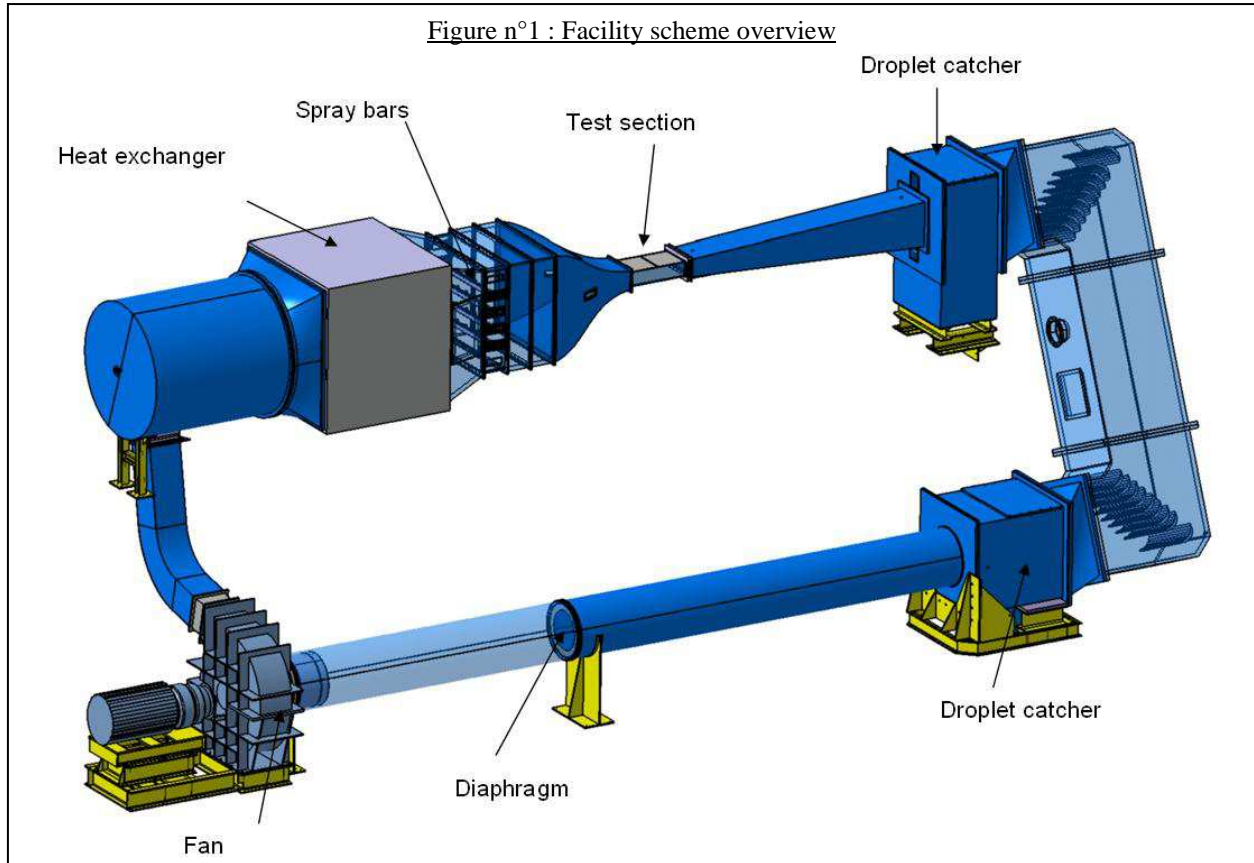




Figure n° 2 : test section external view



**Financial elements:**

Replacement cost (M€uros)

- |               |                                     |
|---------------|-------------------------------------|
| Less than 10  | <input type="checkbox"/>            |
| 10 to 30      | <input checked="" type="checkbox"/> |
| 30 to 60      | <input type="checkbox"/>            |
| 60 to 100     | <input type="checkbox"/>            |
| More than 100 | <input type="checkbox"/>            |

**Practices concerning:**

Access policy: contract or lease

**Comments:**

Possibility of altitude simulation (upgrade required)

**Origin of information:** Franky Le Mézo – Avril 2013