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## ***Ground Testing Support of the Airbus A380 Super-Jumbo Project***

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**AEROSPACE  
TESTING  
EXPO 2005  
EUROPE**

**Office National d'Études  
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# Presentation Outline

- Brief Introduction to ONERA-GMT
- Airbus connection
- What have we done?
- Specific examples:
  - Empennage loading
  - Drag identification
  - Noise reduction
  - Free flight tests
- Conclusions



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# Grand Moyen Technique (GMT) Division

**Working to support industry and science**

## Description of Activities

### Complete Testing Services

- **Ground testing.**
- **Model design and manufacture.**
- **Engineering support for design and manufacture of test hardware.**
- **Balance design, manufacture, and calibration.**

**Utilizing a powerful, responsive integrated team, deploying unique facilities and expertise within Europe.**



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# Airbus Family in the Low-Speed F1 Wind Tunnel



**A300**



**A310**



**A318**



**A320**



**A330**



**A340**



**A340-600**



**A380**

# Airbus Family in the High-Speed S1 Wind Tunnel



1981 - A310



1986 - A320



1989 - A340



1996 - A330



1997 - A340- 600



1999 - A318



2001 - A3XX/380

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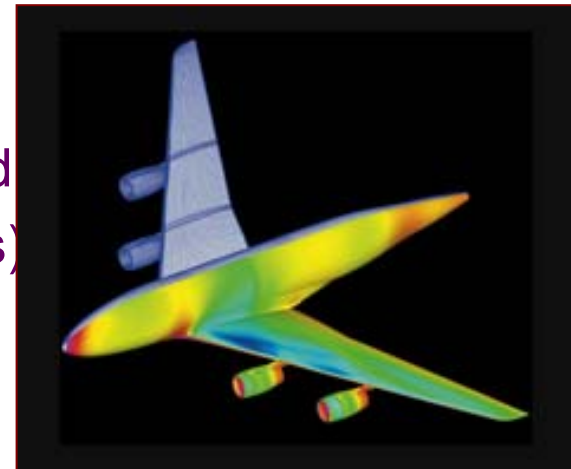




# ONERA 's Contribution to A380 R&D

## Science & Experiments: 1995 to 2005 - 10 Years of Support

- Computational analyses (aeroelasticity, acoustics, drag, etc.)
- Wind tunnel tests:
  - Performance characterisation over the complete flight envelope
  - Engine integration
  - Drag identification
- Free flight models (wake & drag studies)
- Acoustic tests (airframe and engines)
- Vibration tests (complete aircraft)



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# A380 Models in the F1 Wind Tunnel



**Full-model (3 mast)**



**Half-model**



**Air Inlet**



**Full-model (single strut)**

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# A380 Performance Tests in the F1 Wind Tunnel

Large-scale model with U/C



Support tares using fin-sting



# A380 Models in the S1MA Wind Tunnel



Half-model



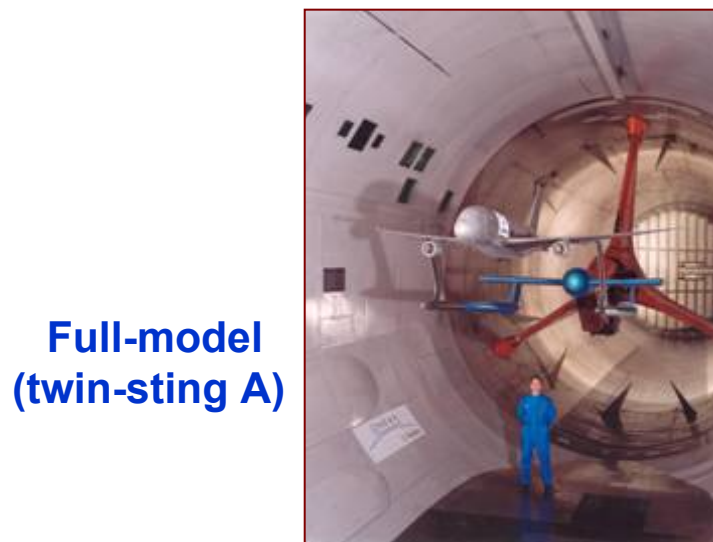
Full-model (straight sting)



Full-model  
(twin-sting B)



Air Inlet



Full-model  
(twin-sting A)



Full-model  
(Z-sting)

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# GMT Test 2003 - Empennage Loading using Twin-Stings

**Full-Span A380 Model (1/26 scale)**



**Dummy Z Sting**



**Dummy Straight Sting**



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# GMT Test 2003 - Empennage Loading using Twin-Stings

## Objectives:

- Measure the forces and moments acting on the tail.
- Determine the effects of sting interference on the empennage loads.

## Results:

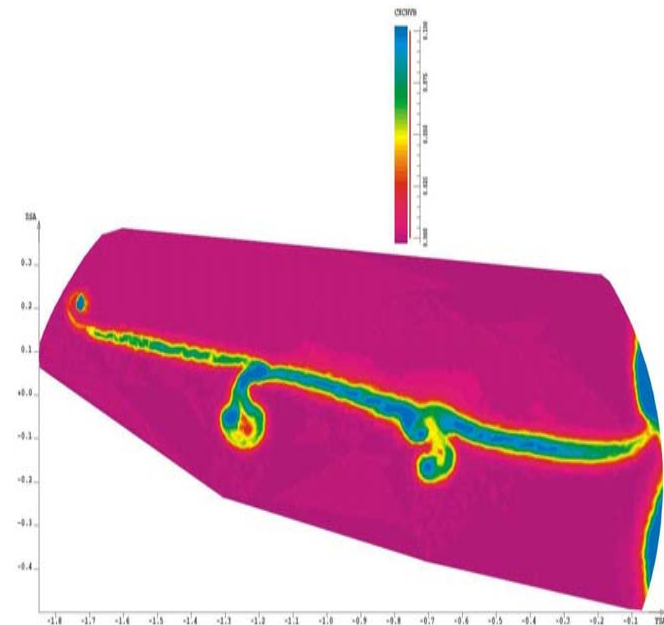
- Two twin-sting supports available in S1MA.
- Straight and Z sting interferences examined.
- Test performed from Mach 0.35 to 0.9+.
- Alpha range  $-3^{\circ}$  to  $+9^{\circ}$ ; Beta range  $\pm 6^{\circ}$
- Five empennage configurations tested.

# GMT Research Activities 2003: Drag Identification



**Half-model with wake traversing mechanism**

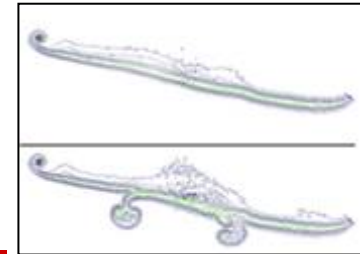
## Wake Survey in S1MA



# GMT Research Activities 2003: Drag Identification

## Objective:

Drag evaluation, by breaking out the various contributions, for different model configurations.



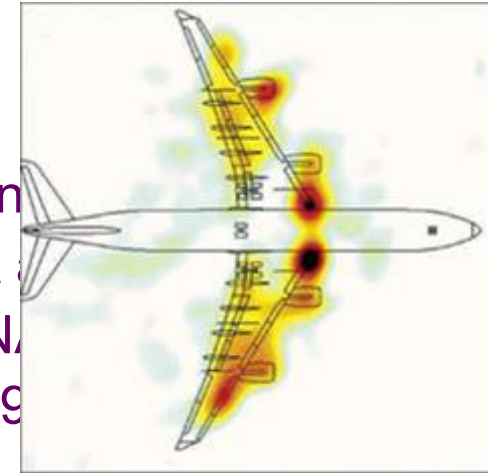
## Results:

- Wake surveys carried out up to Mach 0.85, using half-models.
- Probe position known to within  $\pm 2$  mm.
- Effect of probe holder is less than one drag count.

# Noise Reduction Support

## Key Areas:

- ▶ Motor installation effects :  
RAIN, SILENCE(R), ROSAS tests in
- ▶ Flight measurements : SILENCE(R) test
- ▶ Noise reduction analyses : ONERA-DSN
- ▶ Airframe noise : RAIN tests in CEPRA 19



## Major Contributor to European Projects:

RESOUND – RANNTAC  
RAIN – DUCAT – SILENCE(R)  
AWIATOR – ROSAS – SEFA  
JEAN – X-Noise network

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# ONERA-DLR Activities 2003: Free Flight Tests

## ONERA-Lille B20 Catapult Facility



Length - 90 m  
Width - 20 m  
Height - 20 m

ONERA built free-flight model  
(Scale 1:35)  
2.25 m (7.4 feet) span



Model wakes  
(up to 200 chords  
downstream)

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# Conclusions

- ✈ Ten year of A3XX/380 involvement
- ✈ Full spectrum of testing support
- ✈ Testing services continue to evolve
- ✈ Better equipped to satisfy the needs of future projects

**Ground Testing Essential  
for New Airliner Projects**

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