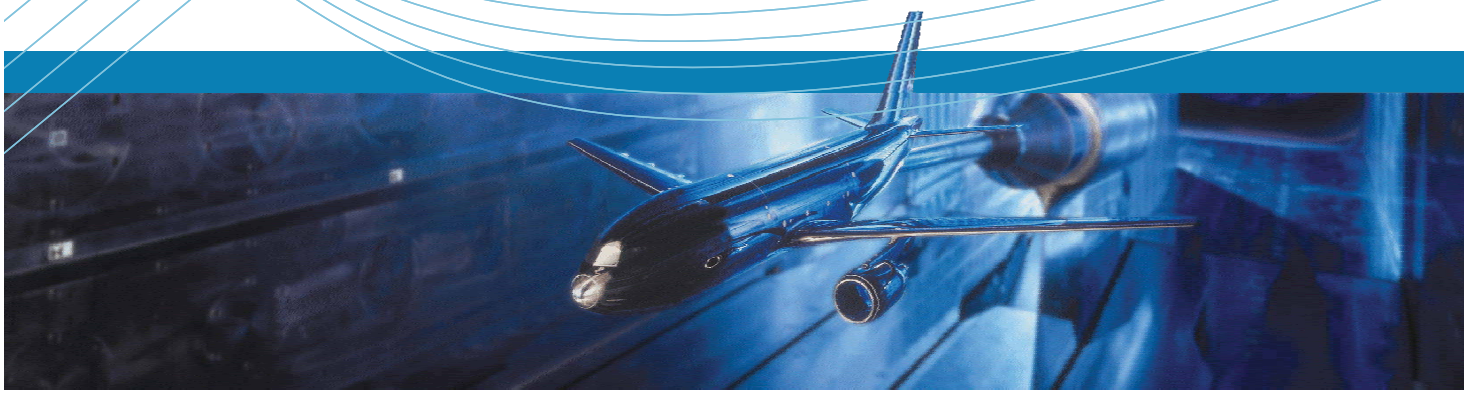
EUROPEAN TRANSONIC WINDTUNNEL



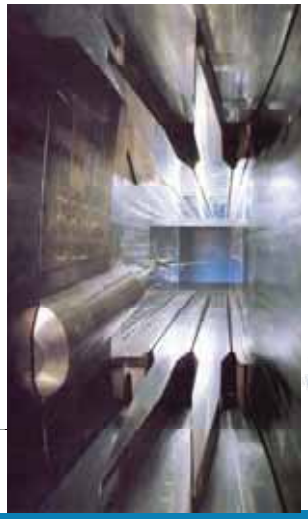
Flight-Reynolds Testing on Ground

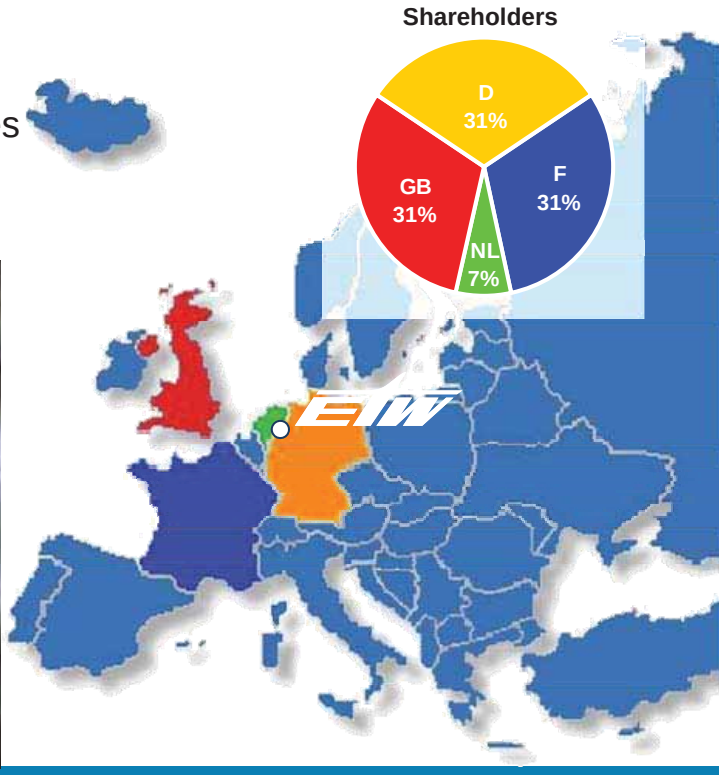
Dr. Guido DIETZ
Managing Director, Tel./Fax: +49 (2203) 609-110/-124, GD@etw.de

EUROPEAN TRANSONIC WINDTUNNEL

Bridge from Conventional Simulation to Flight Testing

- **European cryogenic wind-tunnel**
- **Self-supporting / non-profit policy**
- Limited-liability company, 36 employees
- Military-compliant secured site

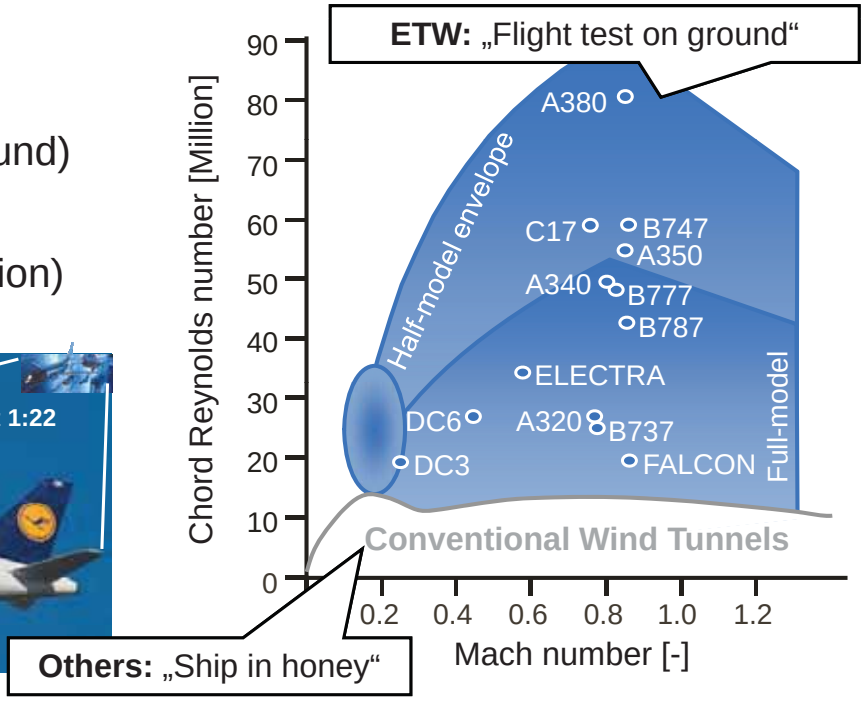




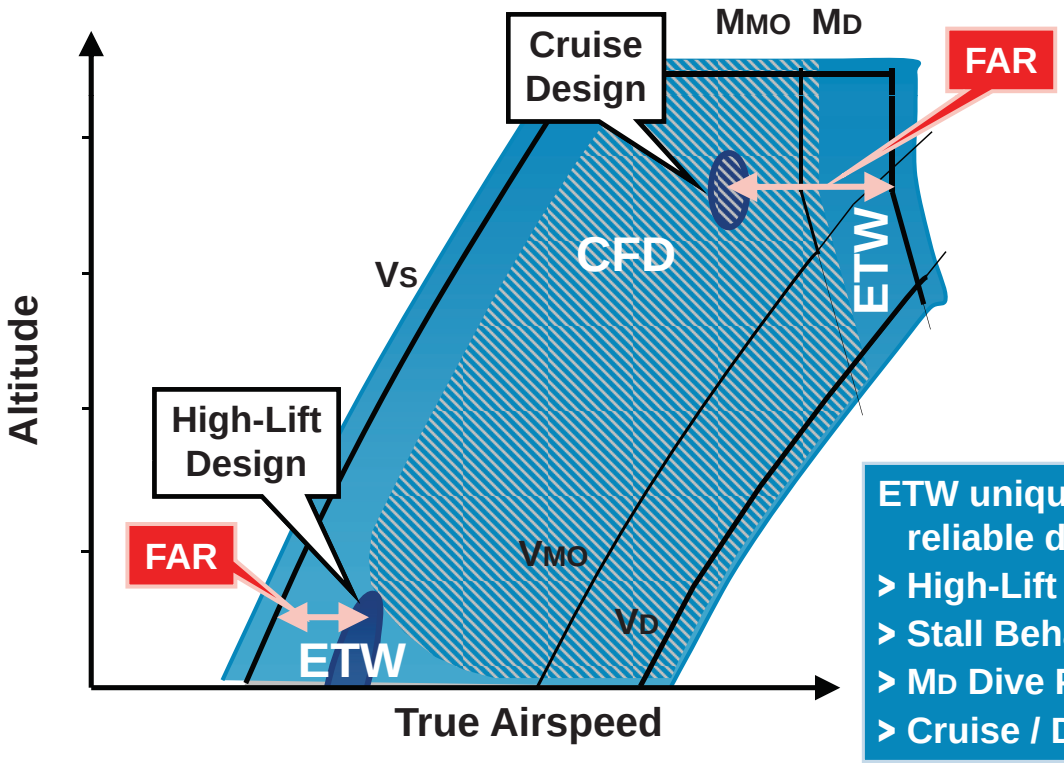
Most Advanced Aeronautical Wind-Tunnel

Full similarity between real aircraft & wind-tunnel model:

- **Geometry**
- **Mach number**
  (Velocity per speed of sound)
- **Reynolds number**
  (Air inertia forces per friction)



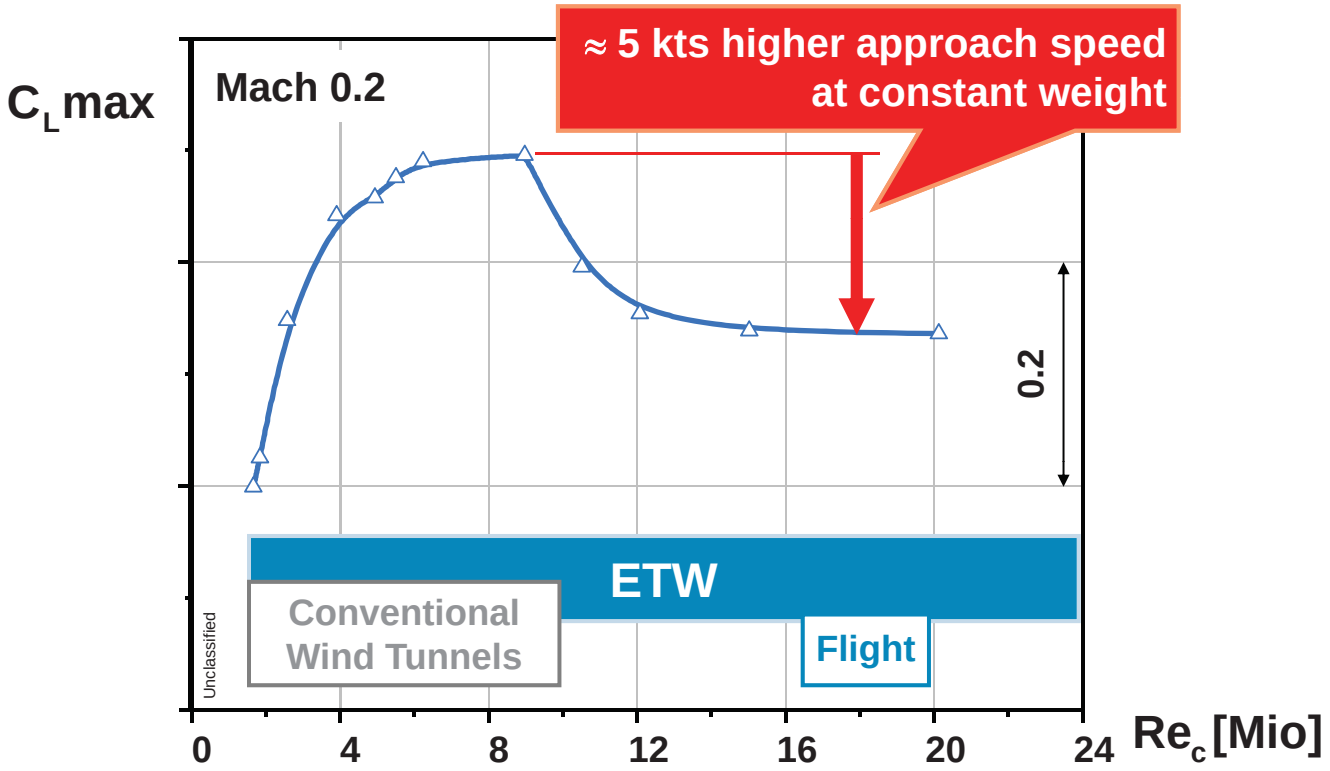
Flight Envelope – ETW complements CFD



ETW uniquely provides reliable data for

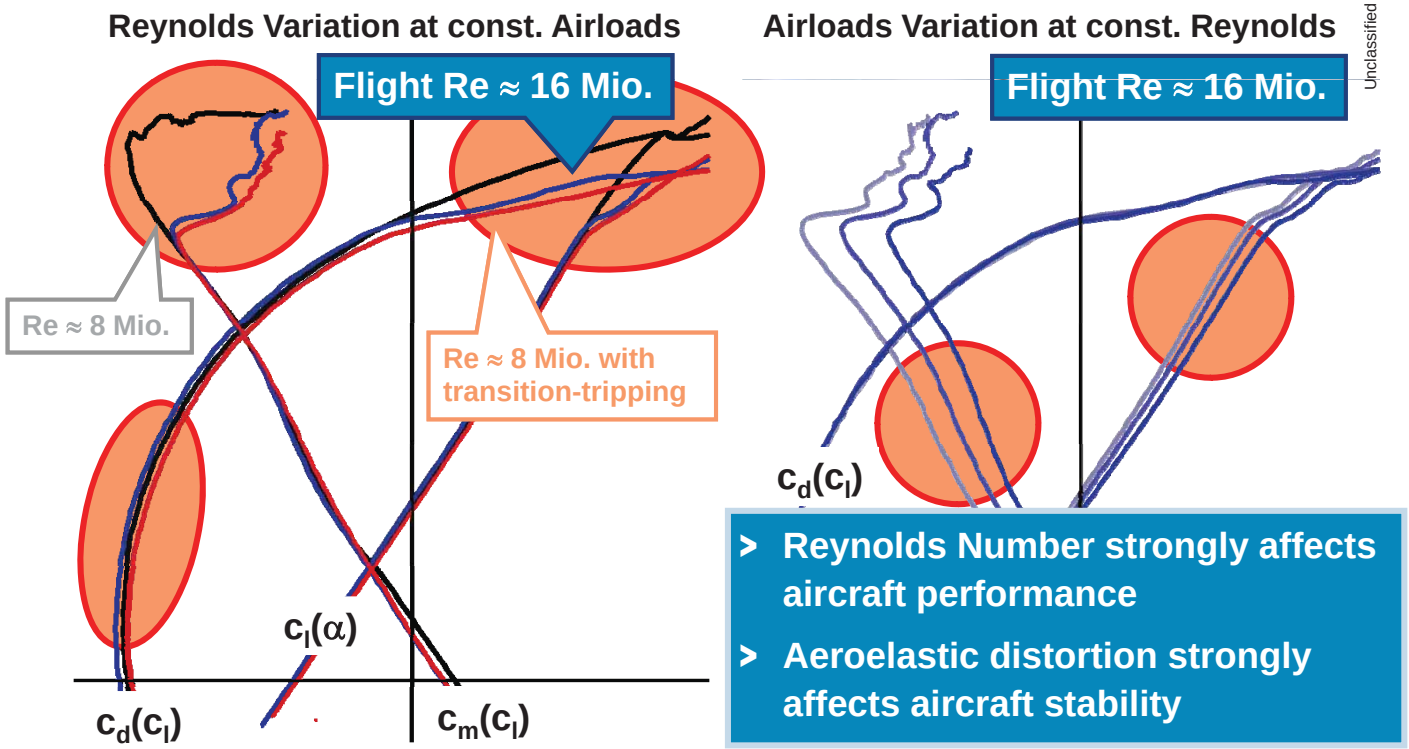
- **High-Lift Design**
- **Stall Behaviour**
- **MD Dive Properties**
- **Cruise / Dive Separation**

Reynolds-number effect on maximum lift



Independent Variation of Re-Number & Structural Loads

Lift, drag, pitching-moment characteristics Falcon 7X



- Reynolds Number strongly affects aircraft performance
- Aeroelastic distortion strongly affects aircraft stability

ETW Supports and Links Academia and Industry

Research Infrastructure

- Scientific research at flight conditions
  - e.g. new aircraft configurations
  - e.g. advanced flow control
- New test-technology development

Science

Innovation

- Final configuration check-out
- Validation of CFD and CAE codes
- Aircraft design for flight-Reyn. No.

Development Tool

EUROPEAN TRANSONIC WINDTUNNEL

Current Research Efforts

Advanced aircraft

- Drag reduction by laminar flow control (EU-TELFONA/DESIREH)
- Transnational access (EU-ESWIRP)

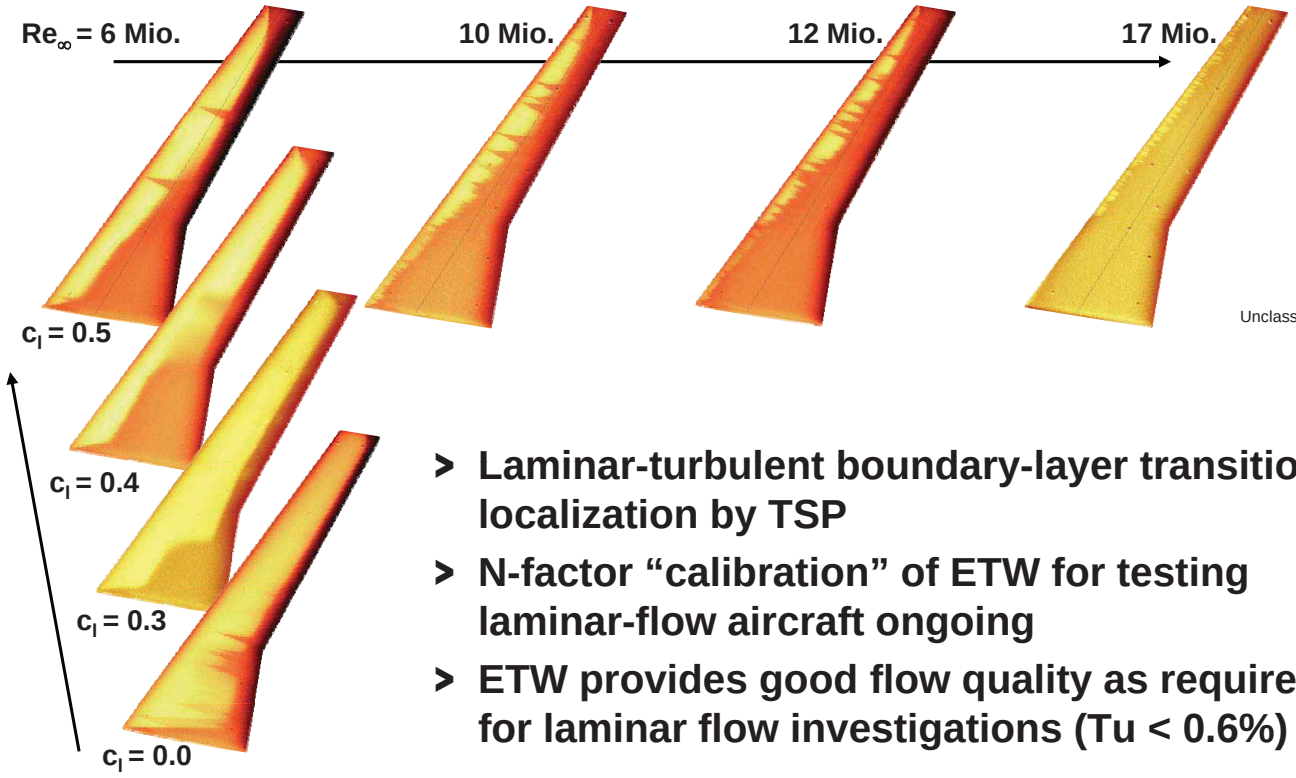
Improved aircraft development process

- Wind-tunnel testing synergy (EU-SWIFT)
- Flight validation and improved complementary usage of high-lift CFD simulation and ETW testing (DEU-HINVA)

Advanced testing techniques

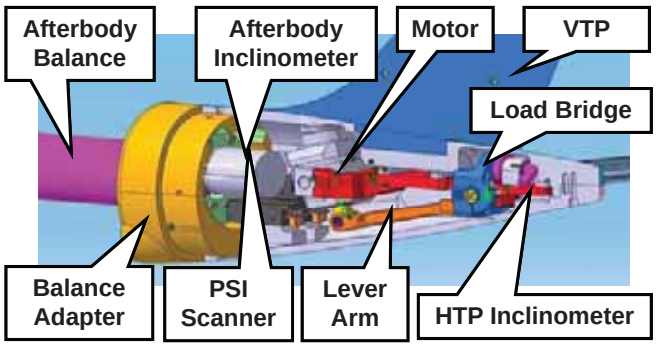
- Temperature-/pressure-sensitive paints TSP/PSP (DLR cooperation)
- Remotely controlled control surfaces (NLR cooperation)
- Engine simulation (DEU-ITS)
- Acoustical Localisation of Flow Separation (DEU-ALSA)

Laminar Flow Control and TSP Development



- Laminar-turbulent boundary-layer transition localization by TSP
- N-factor “calibration” of ETW for testing laminar-flow aircraft ongoing
- ETW provides good flow quality as required for laminar flow investigations (Tu < 0.6%)

Remotely Controlled Horizontal Tail Plane



Reached Objectives:

- **Handling quality, and loads** data at flight Reynolds numbers
- Avoid model-transport/-change, and -conditioning time

ESWIRP EU Project in FP7

European Strategic Wind tunnels Improved Research Potential

Joined effort of the 3 ACARE strategic wind tunnels


ONERA S1


DNW LLF


ETW

- to further integrate and maintain these facilities at a world class level
- to better complement each other in terms of speed, size and flight condition simulation for future “green” aircraft development
- to facilitate European researchers to turn scientific ideas into technological innovations as aimed by the Lisbon strategy

EUROPEAN TRANSONIC WINDTUNNEL

ESWIRP EU Project in FP7

European Strategic Wind tunnels Improved Research Potential

Limited but free-of-charge access for European researchers in ESWIRP

- Call for test proposals due in 2012
- Groups of scientists/researchers submit sketches outlining scientific objectives and approach allowing to assess the innovative potential and scientific value for the community
- Review process evaluates compatibility with FP7 & ESWIRP objectives, scientific excellence and value versus objectives of “Clean Sky”