

EU's aeronautics wind tunnels in the global competition

*Aeronautics Research & Testing Infrastructures
– Key for Europe's Competitiveness in Aviation*

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German-Dutch Wind Tunnels

ACARE AirTN

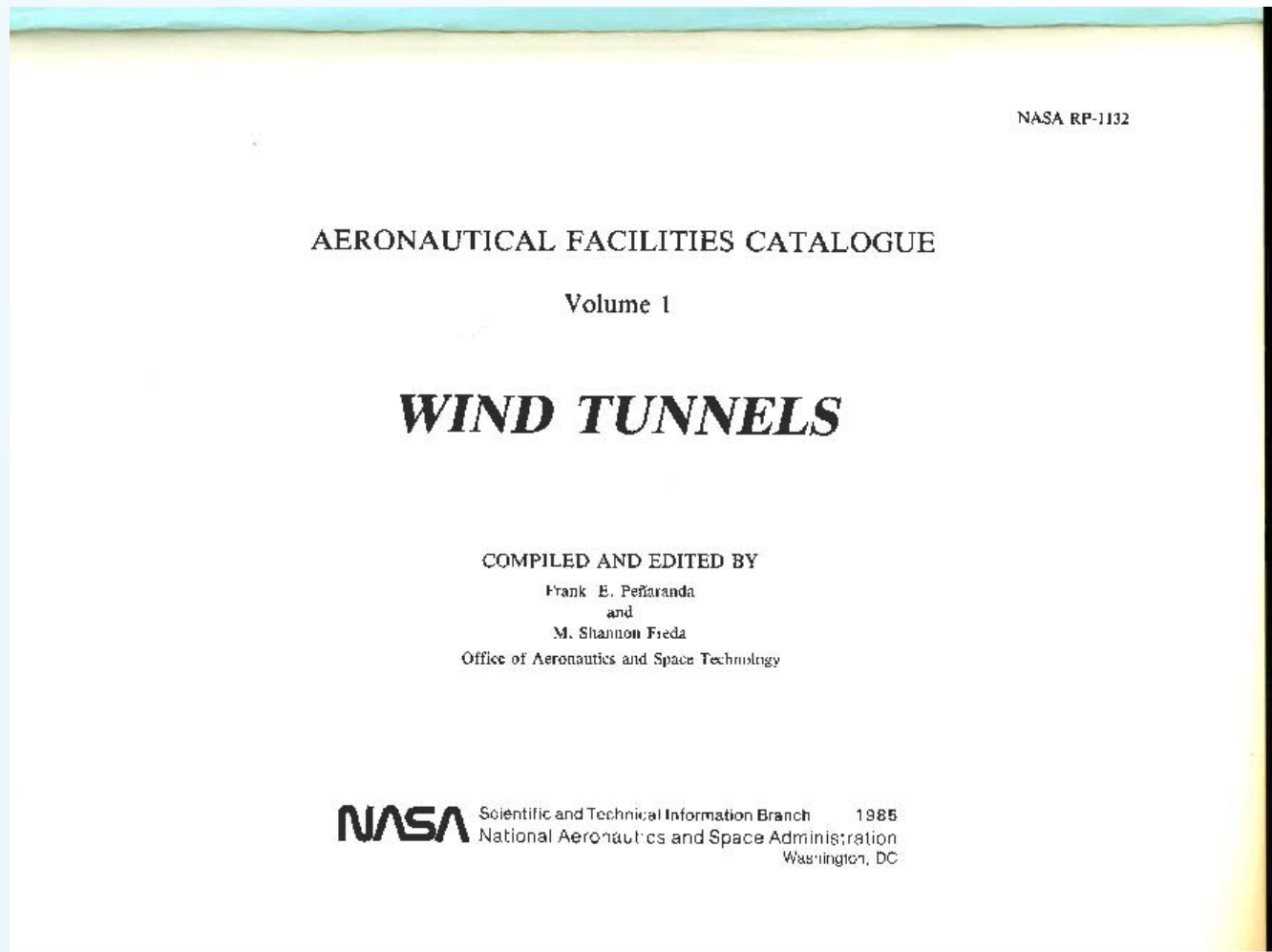
25 February 2013

ACARE flight path to industrial competitiveness in SRIA

Continuous and focused investment

- ❑ 2020 - Identify and maintain strategic infrastructure (wind tunnels, test aircraft, computers)
- ❑ 2035 - Single European facility management with common strategy for decommissioning, upgrade, and installation of facilities
- ❑ KPI - Balanced use/financing of facilities by research (public) and industry (private): industrial participation is necessary ingredient

Global competition a generation ago



Compendium of major wind tunnels...

| Country | Subsonic | Transonic |
|---------------|-----------|-----------|
| US | 42 | 26 |
| Foreign | 34 | 22 |
| <i>Canada</i> | <i>3</i> | <i>1</i> |
| <i>FR</i> | <i>5</i> | <i>6</i> |
| <i>GE</i> | <i>4</i> | <i>4</i> |
| <i>JN</i> | <i>7</i> | <i>5</i> |
| <i>NL</i> | <i>2</i> | <i>1</i> |
| <i>UK</i> | <i>13</i> | <i>5</i> |

...of which premier capabilities

| Speed range | EU | US |
|-------------|------------------------|----------------|
| Subsonic | 1 NL (DNW) | 3 NASA |
| | 1 UK (5m) | 3 Industry |
| | 1 FR (F1) | |
| Transonic | 1 FR (S1) | 1 AEDC |
| | 1 GE (TWG) | 4+1 NASA (NTF) |
| | 2 UK (Bedford, Warton) | 8 Industry |

Note: HST and S2 not in this list



Change since then in the “premier league”

- ETW and CIRA-IW established in Europe
- Russian tunnels become accessible, e.g. T 128



Change since then in the “premier league”

- China joins the “premier league” with CARDC and AVIC-ARI



◀ FL-10*

**Single-return
open/close test section
low speed wind tunnel**

Test section size: 8m(W) × 6m(H)

Max Velocities: 100m/s (close test section)

85m/s (open test section)



Cf. DNW-LLF, a “compliment”



German-Dutch Wind Tunnels

Further developments

- NASA's Aeronautics Test Program core principles
 - National stewardship, *i.e. for self sufficiency*
 - Availability, *i.e. support for all organizations*
 - Relevance, *i.e. continue development*
 - "The Big Stuff", *i.e. focus, not breadth*
 - Value, *i.e. reliability and efficiency*
 - Public good, *i.e. fund strategy*
 - R&T and T&E, *i.e. both research and industry*

- *From full cost accounting to **no cost** accounting*
 - *i.e. prices don't have to reflect costs*



Further developments

- ATP for 13 facilities at four locations

| Budget Authority (in \$ millions) | Actual | | Estimate | Notional | | | |
|--------------------------------------|---------|---------|----------|----------|---------|---------|---------|
| | FY 2011 | FY 2012 | | FY 2013 | FY 2014 | FY 2015 | FY 2016 |
| FY 2013 President's Budget Request | 76.4 | 79.4 | 78.1 | 78.0 | 78.0 | 78.1 | 78.2 |
| Change From FY 2012 Estimate | -- | -- | -1.3 | | | | |
| Percent Change From FY 2012 Estimate | -- | -- | -1.6% | | | | |

- Operations support
 - Maintenance and upgrades
 - Test technology research and development
- Plus fundamental aeronautics program ≈ 175 M\$



Further developments in EU

□ EWA: European Wind tunnel Association

- NoE - with EU support of 7.5 M€ over 5 years - of 14 participants from research and WT operators incl. industry

□ ESWIRP

- Three strategic* wind tunnels receive one time** support for joint research, upgrades and TNA
 - * *Definition from ACARE facilities' WG*
 - ** *One project, 7.5 M€ with four years duration*

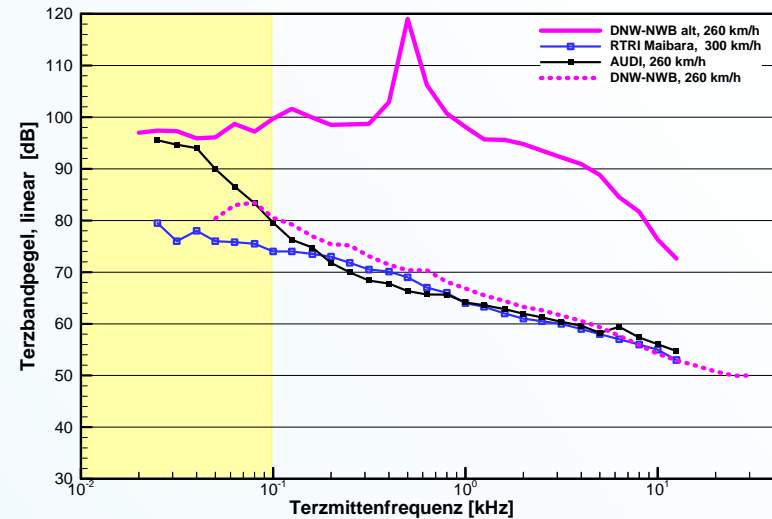
□ National support is significant for achieving European goals



National support for European goals

□ Acoustic upgrades

- $Re = \frac{u_\infty L}{\nu}$
- but $Str = \frac{fL}{u_\infty}$
 - (for propulsion $J \sim Str^{-1}$)



□ Reliability, accuracy and efficiency

□ Instrumentation research in national laboratories

□ ➔ Large wind tunnels are still competitive



Current competitive situation

- ❑ Competition within EWA – for budgets for research activities. No stable alliances beyond DNW and ETW. Some EWA member are globally present.
- ❑ Competition with established capacity outside EU – limited by national priorities and the global binary structure of major aircraft developments
- ❑ Competition with new entrants – benefit of experience and know how needs to be maintained



Current competition for projects

- ❑ Europe has some of the most competitive wind tunnels world wide. For how long?
- ❑ See global attractiveness of DNW, see also the density of users in the EU:



- ❑ Same user community for the other ESWIRP partners. Perhaps also further operators.



Current situation

- ❑ Not all EWA partners target global markets; industry is extremely focused.
- ❑ Industry is also volatile



- ❑ Military testing complements the civil aeronautics

Effect of volatility

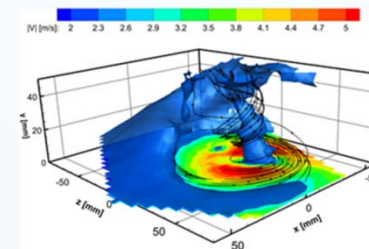
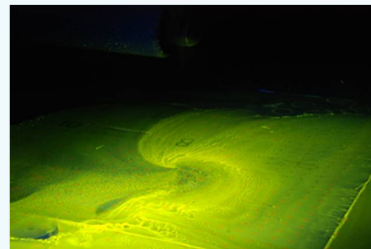
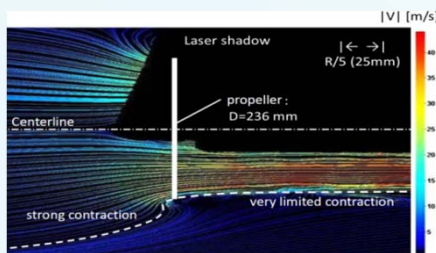
- ❑ Need to assure survival in the trough and availability during the next peak demand
 - Broaden customer base
- ❑ Broadening of customer base dilutes priorities
 - Priorities are required for competitiveness
- ❑ Strategic considerations are interfered with by survival strategies
- ❑ → Continuous component of occupation required in order to maintain and generate skills
- ❑ → Commitment needed from the strategic users

The need for continuous research access

- ❑ Long term preparation required for model and tunnel in research projects

$$T_{\text{preparation}} \geq T_{\text{PhD thesis}}$$

- ❑ Need for skill developments at academic institutions
- ❑ Industry communication and support is essential
- ❑ Continuous and established access at European level will motivate academic involvement in skill development



Conclusions

As elements of retaining a globally competitive position of wind tunnels (and also of European industry)

- ❑ Further deepening of specialization
- ❑ Continuous research involvement (e.g. through an institutionalized TNA)
- ❑ Involvement and commitment by the industry
- ❑ ...

are required

who will fund the strategy?

