European Transonic Windtunnel GmbH
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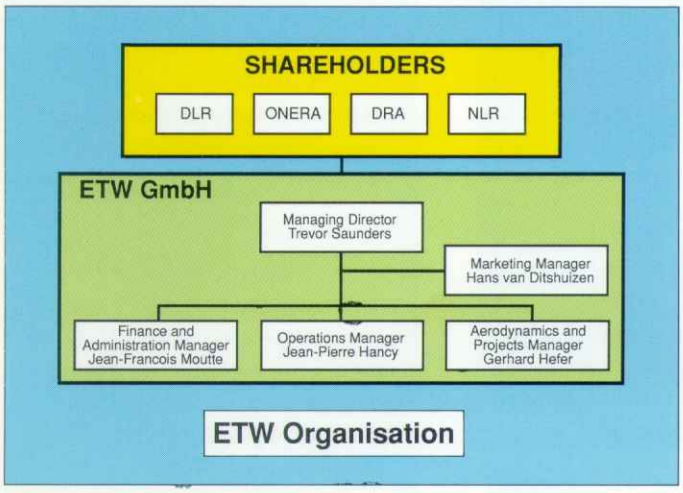
Issue No. 1, May 1994

News

Welcome

Welcome to the first ETW Newsletter. This we hope will be the first of many in a long line of newsletters informing you of the latest developments in ETW and in techniques employed in high Reynolds number wind tunnel testing. I'm very grateful that Hans van Ditshuizen, the ETW Marketing Manager, has taken it on himself to compile and edit this publication which is to be sent out to interested parties in the aerospace industry, establishments, government departments and press.

ETW, as you are perhaps aware, has been a very successful project. It was mechanically completed on schedule and within budget in December1992 and hosted a very enjoyable Inauguration Ceremony in June last year. In keeping with this good tradition the present commissioning and calibration of the facility is progressing well with only minor problems being encountered. Later this year we open our doors for customer testing. It is gratifying to know that our confidence in the facility is shared and that seven clients are in various stages of preparing tests. Three of these are already booked for the tunnel this year.



These newsletters, as well as providing an insight into the facility and its work, should also provide an introduction to the people working here. To start this off in this first issue I have presented the management and functional organization chart of ETW for the operational phase.

Whilst every effort will be made to cover all aspects of ETW we will welcome comment, and even crititism, from you if you feel any areas are neglected.

Trevor Saunders

ETW Managing Director.

First Customer

Deutsche Aerospace Airbus GmbH, from Bremen, will be the first customer of ETW. Their model of the Airbus A310 will arrive at ETW in the next few months for testing later this year. The model will be rigged and checked out at both ambient and cryogenic conditions in one of the variable temperature checkout rooms before entering the tunnel. The tests are being conducted under a co-operation agreement with ETW to enable the client to get experience of the facility and to explore its capabilities. This type of arrangement is being offered for a limited period to all new customers.

The model which has already been tested in the KKK, the DLR low speed cryogenic wind tunnel, was made approximately 18 months ago to ETW load requirements. The model in its initial build will be for force and moment testing. A new pressure plotting wing is currently being manufactured for testing in ETW later in the year.

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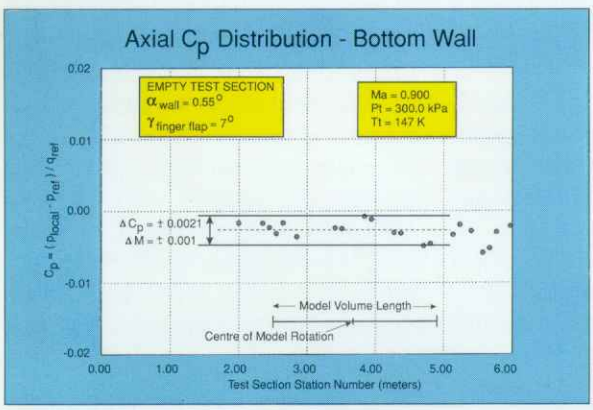
Light at the End of the Tunnel

The commissioning and calibration of the facility is well underway. The tunnel has operated up to Mach 1.34, 4.5 kPa and down to 107K. The control of the facility has throughout the commissioning been undertaken in the automatic mode which has performed extremely well.

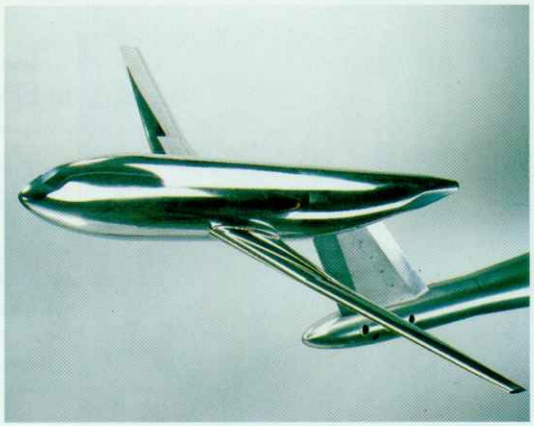


The calibration campaigns are designed to check the quality of the flow. The major equipment and tests for these campaigns comprise: test section axial probes to measure the centreline pressure distribution and determine geometrical adjustments (wall angles, reentry flap positions); a rotating rake to explore the flow field (pressure, temperature, flow angularity, turbulence) at 3 axial positions in the model volume; a check out probe to check flow stability and the flow reference system; boundary layer rakes on all 4 walls, turbulence measurement in the settling chamber and in the test section; temperature distribution in the settling chamber; and noise measurements in the test section, plenum and high speed diffuser.

The results from the initial analysis of these data are very encouraging and indicate that the stringent flow quality goals should be achieved. The figure shows the axial Mach number distribution obtained at M=0.90 along the bottom wall of the test section.

ETW has also had a reference model built to develop test methodology on a realistic case and, in the future, check long term repeatability as part of the quality control plan. For this purpose the selected model is the well known F4 configuration which simulates a generic transport aircraft. Results indicate that repeatability of better than one drag count is being obtained even at this early stage of testing. The results compare well with data obtained even at this model tested in a number of other european facilities. The figure below shows the model mounted on a „Z" sting ready for entering the tunnel.

Discussions with several interested clients on test programmes and cost charging are already well advanced and models are already being manufactured. The first client tests are planned for the second half of the year.



ETW reference model mounted on „Z" sting

News in Brief

Two contracts have recently been placed for wall interfence and correction studies with City University of London and DRA.

Jan v. d. Bliek, the former director of NLR and AGARD, has been requested to write a report on the History of ETW. The paper is expected to be published early next year.

Xavier Bouis, the former Director General of ETW received the award of Legion d'Honneur from the French government in December last year. The award is in recognition of his contribution to European aerospace technology in the project ETW.

Visitors to ETW

Recent visitors to ETW included:

Dr. Wesley L. Harris, Associate Administrator for Aeronautics at NASA.

Col. Lawrence P. Graviss, Commander AEDC, and

Mr. Albert Boudreau, Director for International Affairs.

Dr. John W. Davies, General Manager Calspan Corporation.

Graham Harris, former Director General ETW.

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An Introduction To ETW

The European Transonic Windtunnel, ETW, has been funded by the governments of France, Germany, The Netherlands and the United Kingdom, as a High Reynolds Number Facility, for the use of the worldwide aerospace industry. It is situated near the Köln/Bonn airport in Germany. ETW GmbH is a private company formed under German law to manage and operate the windtunnel. ETW started its commissioning and calibration programme at the end of 1992 and will be available for users in the second half of 1994.

ETW is a closed circuit cryogenic windtunnel which uses gaseous nitrogen as the test medium. It is capable of continuous operation, however, to facilitate model configuration and tunnel temperature changes, it is normally operated in the intermittent mode with runs of 10 to 60 minutes.

Safety First

From the inception of the ETW project a safety programme was instigated to run concurrently with the design, construction and operational phases. The most visible example of the programme were three safety reviews at which consultants from recognised safety organizations were free to study and audit all aspects of the facility.

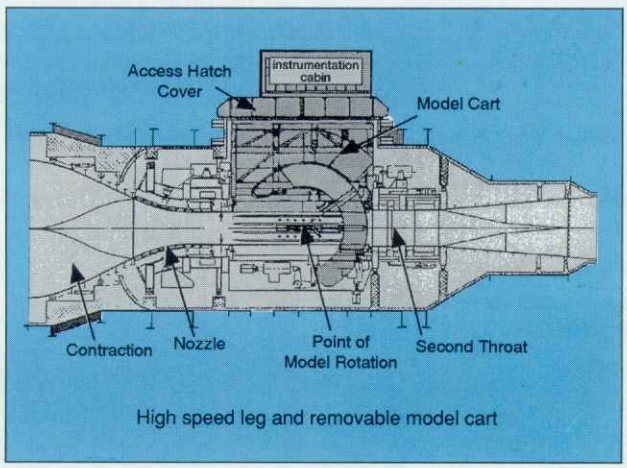
The first review took place in the autumn of 1988 after the initial studies were completed and preliminary designs were available.

The second review was in the spring of 1992 when the consultants had the luxury of conducting the review from our new office building. Civil structures were at an advanced stage and the tunnel shell and plant was being finalised.

The third review is currently being performed. This will include a study of the final documentation from our major contractors and a detailed study of our operating procedures. The report of the findings will be presented to the ETW Board in June and, as before, it will be available for inspection by the statutary and regulatory bodies here in Germany, as well as our potential clients.

ETW Specification

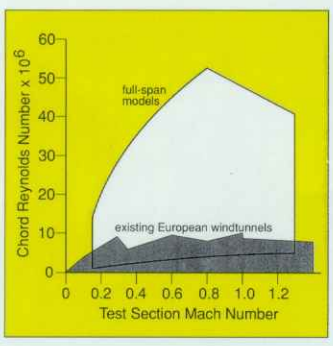
- Test section size:	2.0m x 2.4m
- Mach number range:	0.15 to 1.3
- Pressure range:	125 to 450kPa
- Temperature range:	90K to 313K
- Max. Reynolds number:	230 x 10^6 (1/m)



High speed leg and removable model cart

The high Reynolds number capability is achieved by lowering the test gas temperature and by raising the pressure. ETW utilises a removable model cart system to provide both flexibility of operation and high productivity. The shaded components of the attached figure show one of these removable cart systems. The initial build of ETW has 2 model carts with the future provision for others as demand dictates. The buildings of ETW provide confidentiality of tests within safe and secure areas for users to prepare their tests, rig and checkout their models, acquire their data and analyse their results.

The test section size and the pressure and temperature ranges represent the best combination of parameters to meet the requirement from the aerospace industry to achieve a Reynolds number of 50 million. This is based on a typical transport wing chord of 10 % of the square root of the test section area at a Mach number of 0.9, taking into account the limitations on minimum temperature (condensation effects) and maximum pressure (model loads).



ETW Mach number vs Reynolds number envelope compared to existing European wind tunnels

ETW's will have flow quality at least as good as the quality obtained in the best existing transonic wind-tunnels and, in some ways better, to be consistent with the high Reynolds number goals.

Test Technique Development

Half Model Rig

Discussions with prospective clients have highlighted the requirement for a half-model capability for ETW. The original concept was a dedicated model cart without a sector, the model being mounted from the top wall.

For cost effectiveness, a modification of an existing model cart has been proposed, replacing the top wall by a wall constructed for the half model.

A feasibility study has been made for both this concept and for one with the model mounted on a splitter plate from a side wall. In addition, experiments and calculations on the model sector and wall interferences have been performed. The studies will represent the basis for a decision on the concept to be realized.

Infrared cameras for transition detection

ETW is currently establishing infrared radiometer techniques, which will provide an on-line analysis of test results by sensing infrared radiation over the complete ETW temperature range which is emitted by heat patterns on the surface of the model and corresponds to the actual boundary layer status.

The result of preliminary studies, laboratory checks and verification testing is now available and has been used to start the tender for a first prototype camera which is able to detect temperature differences of less than 0.3 K at a background temperature of 100 K in less than 2 seconds. Prior to the operation with this special camera a standard IR camera will be installed to cover the temperature range down to 200 K.

Personnel

New Managing Director

Trevor B. Saunders was appointed Managing Director of ETW for the operational phase starting 1st October 1993.

Mr. Saunders, who is British, was previously Director, Airframe Technology, at the Military Aircraft Division of British Aerospace Defence Ltd. In that position he was responsible for all aerodynamic, structures, materials and design technologies including the complex of high and low speed wind tunnels at Warton, Lancashire.

He holds degrees in Mathematics and Engineering from Manchester University and the College of Aeronautics, Cranfield and is a Fellow of the Royal Aeronautical Society. After flying with the Royal Airforce in the 1950's he continued as a private pilot until a few years ago.

We wish him every success in completing the commissioning and calibration phase of ETW and establishing its operation on a sound world-wide commercial basis.

ETW Hosts STA

ETW was pleased to be selected as the host for the 80th meeting of the Supersonic Tunnel Association, STA, which was held on the 18-19th October last year. The meeting was attended by 54 engineers and scientists and 27 papers were presented. The meetings take place twice yearly at different venues around the world and act as a forum where users of these facilities can exchange ideas and experiences.

The photograph shows the attendees standing in front of the 3000 tonne liquid nitrogen tank after taking a tour of the tunnel.