

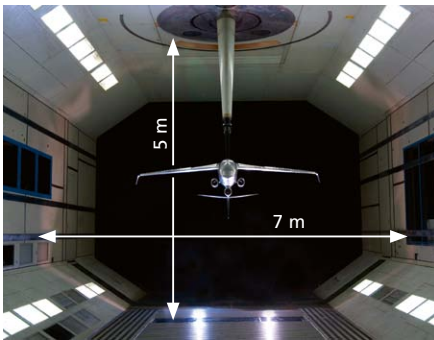
Center Aerodynamics – Center Profile

Center Aerodynamics

The Center provides a modern infrastructure for aerodynamic research investigations and development activities to fulfill customer's needs in the aerospace and automotive field. The two continuously driven wind tunnels, the Large Wind Tunnel Emmen (LWTE) and the Automotive Wind Tunnel Emmen (AWTE) are adaptable to individual testing requirements. Highest precision and efficient measuring process is our philosophy. The aerodynamic competences are supplemented with numerical simulation methods and precise measurement equipment for other wind tunnels.

Large Subsonic Wind Tunnel – LWTE

The LWTE with its large test section and a maximum airspeed of 68 m/s is used for a wide variety of tests. Aircraft models are mounted either on a rear sting, a central strut, a 3-strut or, for minimal interference, on a wire support. A turn table with an external balance and an optional boundary layer floor is available for ground vehicle testing. Soiling tests, where the flow of splash water over a car body is analysed and the functionality of windshield wipers tested, are performed with a special fluorescent water-dye-solution injected upstream of the car. Other fields where aerodynamic effects are important and which are tested in this facility include buildings, sports such as sailing, skiing, bicycle racing and others.



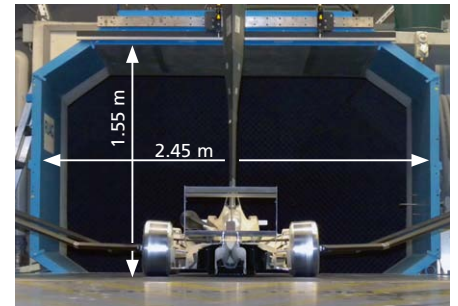
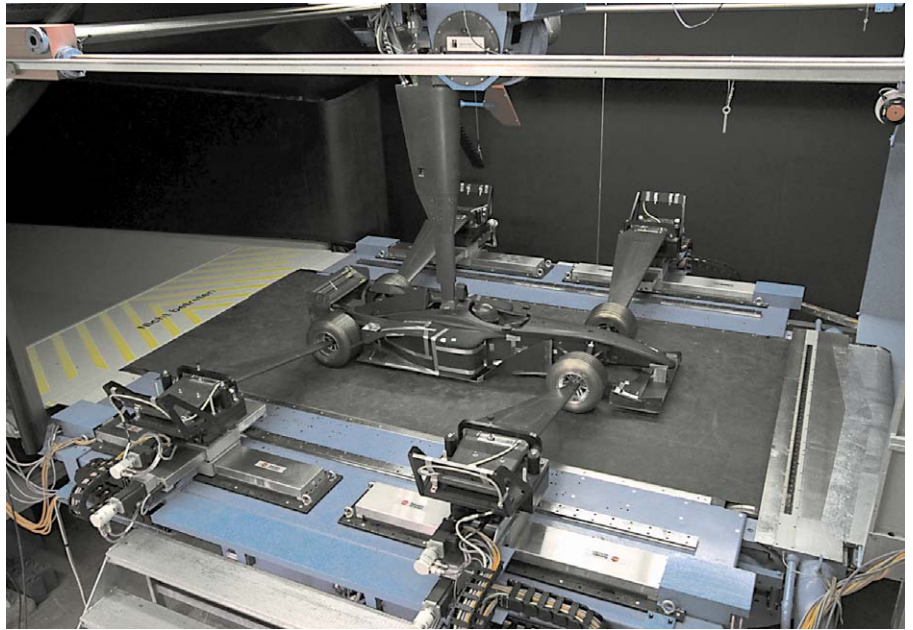
Propeller Simulation

For the investigation of isolated propellers or multi-engined aircraft, compact high-power hydraulic engines are used. The propeller forces are accurately measured with rotating two- or six-component balances.

Experimental Aerodynamics

Automotive Wind Tunnel – AWTE

The AWTE and its infrastructure are optimised for automotive testing and race car development. It features a 3/4-open test section, a maximum tunnel speed of 60 m/s and accepts models up to 50% scale. A moving ground system with a 3.8 x 1.8 m belt, and a flow velocity profile that is within 0.5% of the free stream velocity down to the belt surface, allows the accurate simulation of the relative motion of the car over the road. A fully automated model manipulator controls pitch, roll, yaw and ride height of the model with great precision. If the model is adequately equipped, steer angles can be simulated as well.



Dynamic Model Testing

While race cars run in a highly dynamic environment, aerodynamic testing through state of the art wind tunnel tests, as well as CFD analyses, are mostly performed under static or stationary conditions. Therefore, other than track data, only very limited data

is available on time resolved aerodynamic forces and pressures for a car with realistic quick ride height changes. To investigate these effects a new model manipulator is available, which allows substantial pitch and heave movements up to 20Hz. Wind

tunnel tests with this dynamic system have shown that the difference between a steady state and a true dynamic analysis is significant and can change the characteristics of a car.

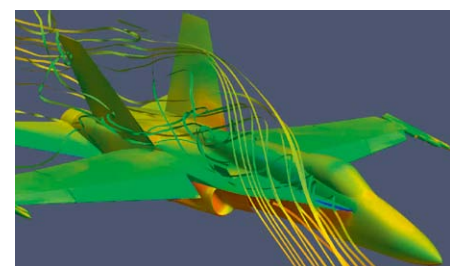
Numerical Aerodynamics

Computational Fluid Dynamics – CFD

The reduced initial expenditure makes CFD ideal for preliminary configuration studies. In conjunction with experimental data validation, CFD allows also detailed flow analysis in the flight envelope which may not be entirely covered by wind tunnel testing. By using the synergies between numerical and experimental methods under one roof we will reduce your development time and solidify the engineering results.

Fluid Structure Coupling

The combination of air induced loads on a structure together with its dynamic structural properties allows the detailed analysis of static deformation under loaded conditions as well as dynamic motion behavior e.g. flutter or general fatigue inducing conditions.

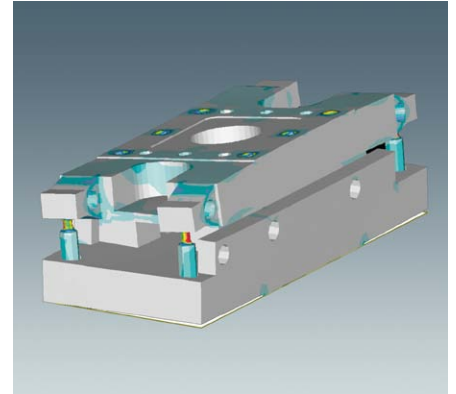
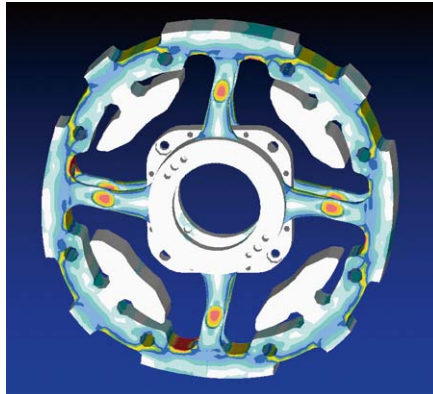


Engineering

Flight Mechanics, Simulations and Consulting

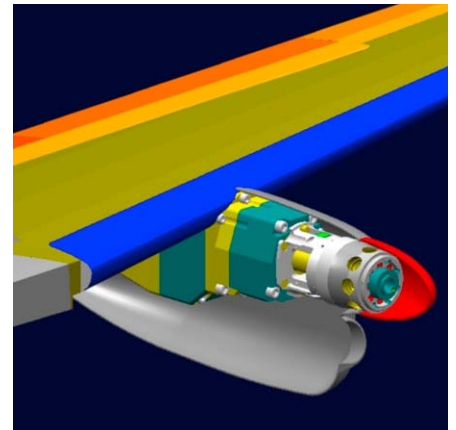
Engineering competences cover a broad field of expertises:

- aircraft performance and stability analysis
- dynamic motion simulation
- store separation prediction
- aeroelasticity and flutter analysis
- ground vibration test and modal analysis
- air vehicle layout and preliminary design
- structural analysis
- measurement equipment and design



Wind Tunnel Models

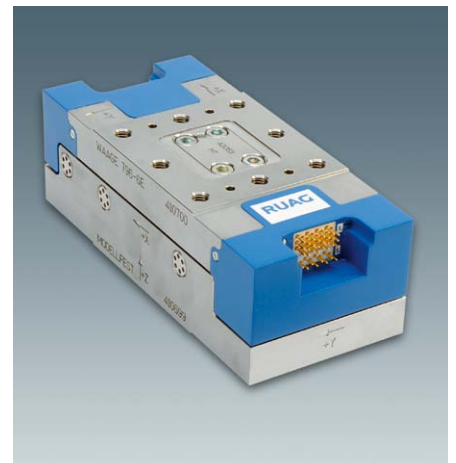
With well designed wind tunnel models a high degree of test efficiency can be achieved. Rapid or automated model configuration changes combined with precise surface dimensions will guarantee fast and accurate measurement results. With the extensive in-house testing and model building experience a wind tunnel model can be provided specifically dedicated to customers needs.



Wind Tunnel Equipment

Supporting other wind tunnel facilities with customized accessories:

- 6-components wind tunnel block and sting balances
- model manipulators and model control systems
- wheel balances for car models
- hydraulic engines for high power wind tunnel aircraft models
- data acquisition systems
- rotating propeller balances and telemetry



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