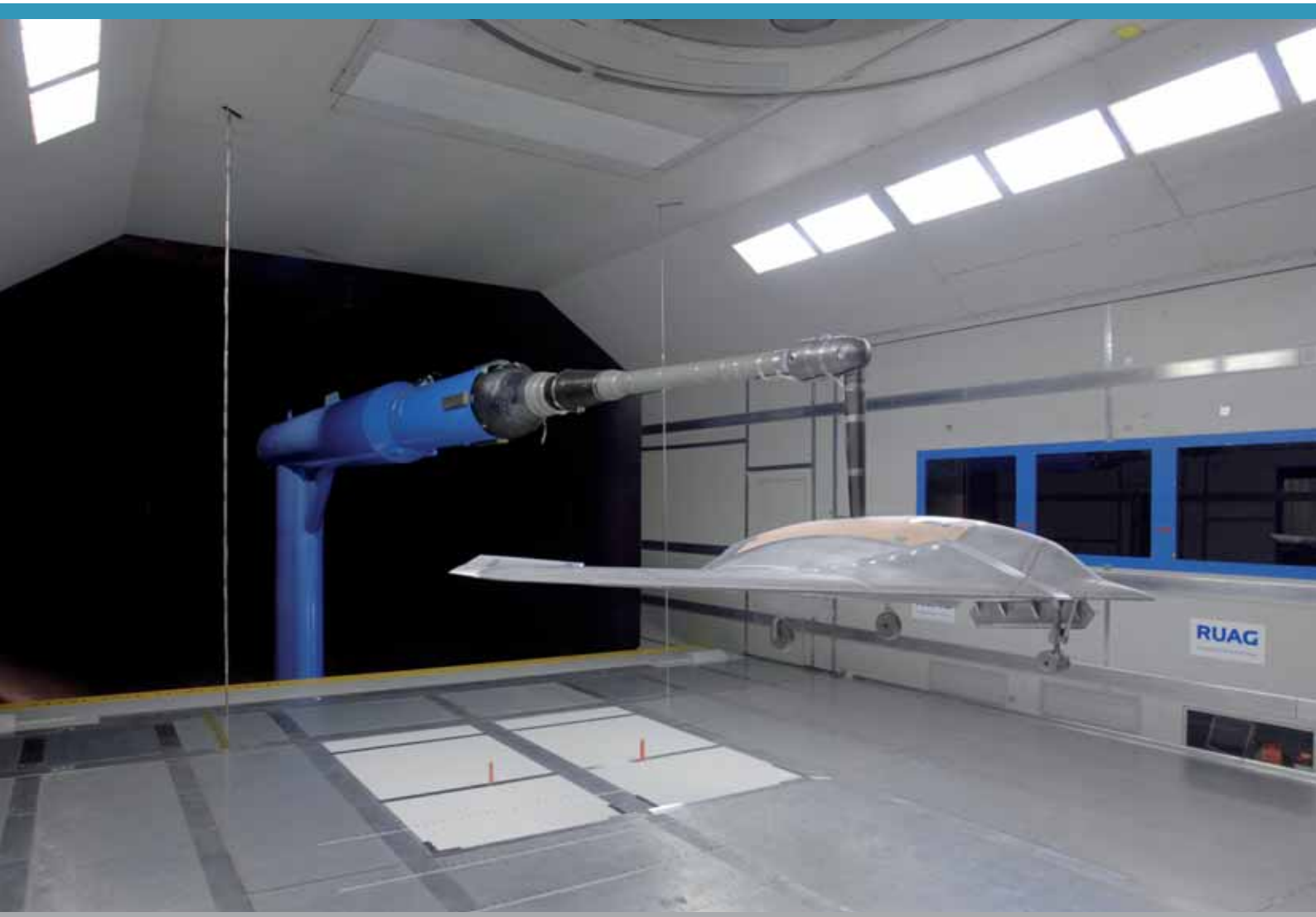
RUAG

Aerospace Defence Technology



Center Aerodynamics – Newsletter 16

Editorial

Dear reader,
UAV and their development are an integral part of today's aerospace environment. Large multinational projects such as the Dassault led European cooperative program nEUROn are aimed at sustaining and developing the technologies for future manned and unmanned air vehicles. Associated partners within the nEUROn program include Saab (Sweden), Alenia (Italy), CASA (Spain), HAI (Greece) and RUAG Aerospace. The first flight of the armed technology demonstrator is scheduled to take place in 2011. RUAG contributes to the program within two distinct areas: the design and manufacture of the pantograph mechanism, which manipulates and releases the internally carried weapon, and the aerodynamic shape development. The numerical and experimental means used in the frame of this project are the focus of this newsletter.

Our "recent activities" section informs you about our latest technological advances with our dynamic model motion system "Shaker". I am also pleased to announce the first course on "Aerodynamic Development of Race and Production Cars" which will be held in our facility during October 2008. During this four day event, well-known industry experts together with our competent staff will give the participants through intense practical work in the wind tunnel a first hand insight into the aerodynamic development of both passenger and race cars. Detailed course information is available on our dedicated web page www.aerocourse.ch.

Sincerely,

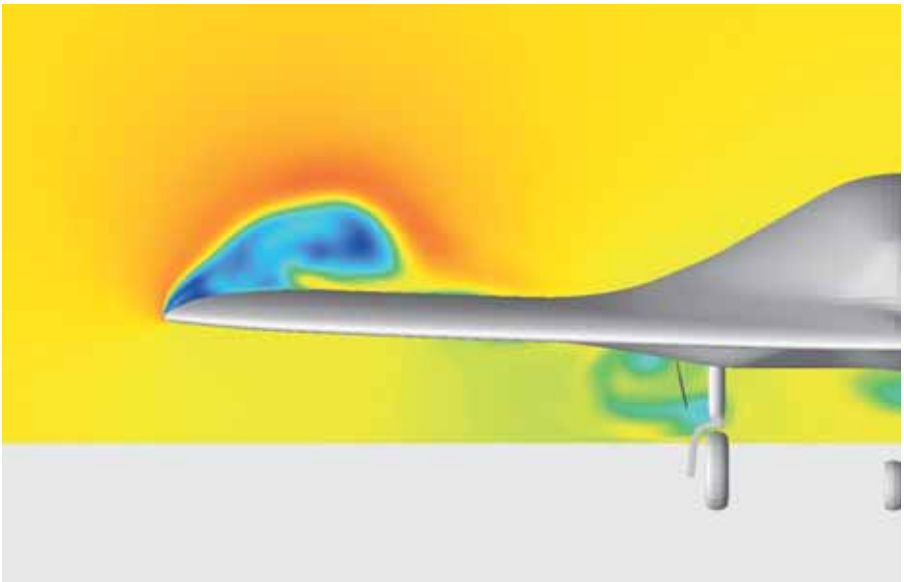
M. Guillaume

Michel Guillaume
Head Center Aerodynamics

Aerodynamic Development of the nEUROn UCAV

For the aerodynamic development of the nEUROn unmanned combat air vehicle (UCAV) demonstrator, the RUAG Aerodynamics Center is involved in two work packages, namely wind tunnel testing and, in collaboration with CFS Engineering, numerical flow simulations.

The main focus of the computational fluid dynamics (CFD) study was to determine the effect of the presence of the ground on the aerodynamics of the airplane (ground effect). In a first step, the numerical method was validated using test cases from the literature and previous wind tunnel measurements on a different airplane.

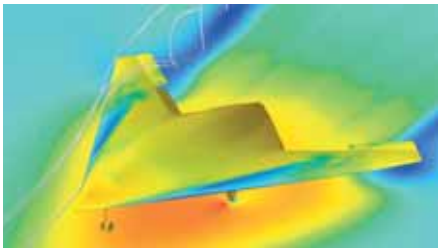


The results were found to be satisfactory and in a second step the actual geometry of the nEUROn was modeled. The simulation matrix included various angles of attack and sideslip, and altitudes over the ground. Due to the unconventional aerodynamics, a good understanding of the effects is of prime importance in order to assure a safe take-off and landing. For this reason, it was decided to confirm and complement the theoretical results by wind tunnel tests.

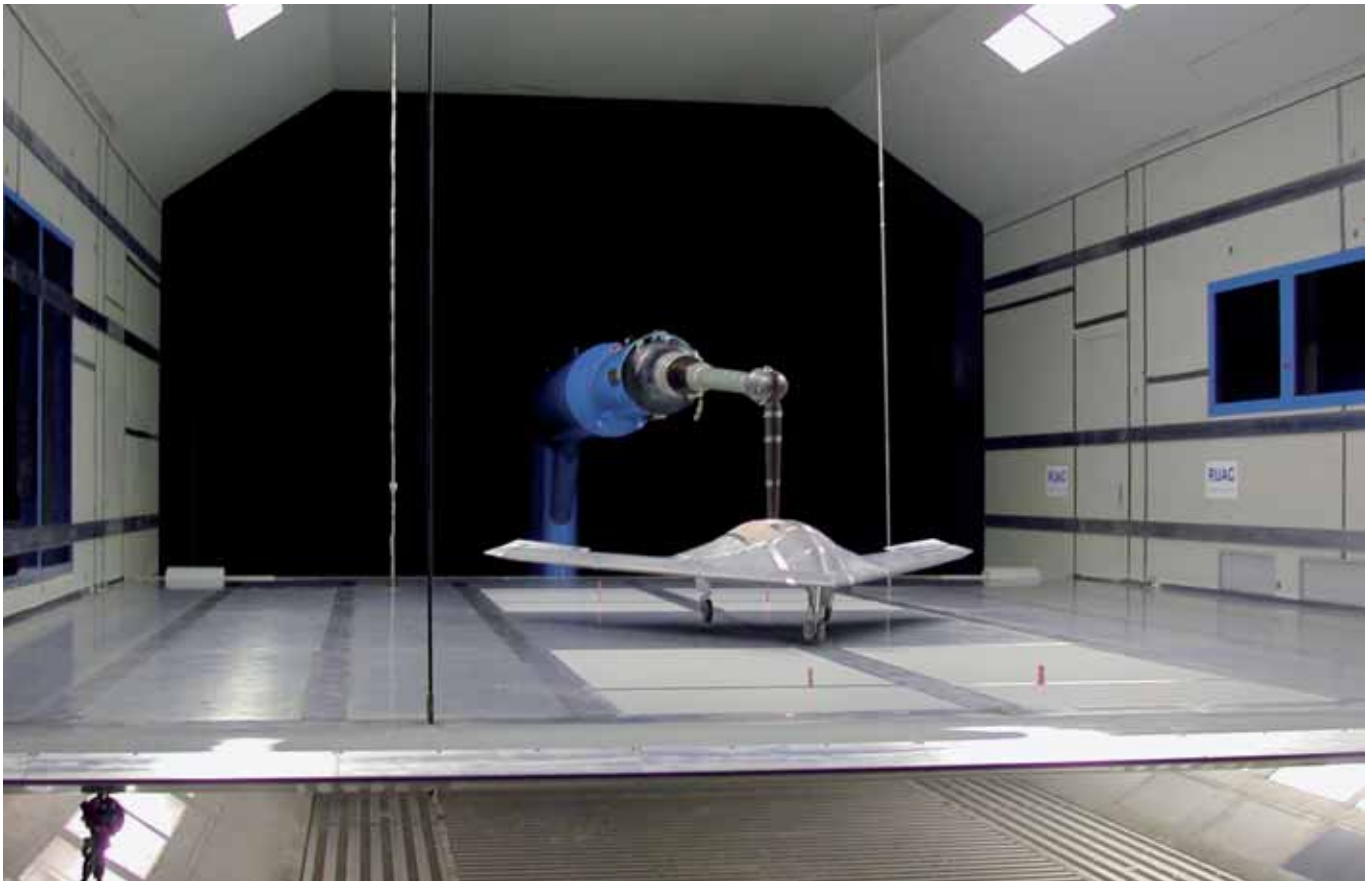
Several wind tunnel test campaigns in the LWTE (Large Wind Tunnel Emmen) were performed during 2007 and early 2008. The first campaigns using a 1:6.7 scale model were aimed at refining the aerodynamic shape of the airplane.

Campaigns with a larger model (1:5) followed. One low-speed campaign was mainly dedicated to the study of ground effect. For this, an intermediate floor is installed in the test section of the LWTE. The model is mounted through a dorsal strut to the rear model manipulator (REMOS). This set-up allows to quickly measure a wide range of angles of attack, sideslips and heights above the floor. The results were found to confirm the data previously obtained from the CFD calculations.

The main goal of the next campaign was to determine the strut interference effects. Different model installation methods were used. By processing the data from the different setups, it is possible to determine the influence of the struts on the measured coefficients. It was confirmed that the rear sting setup is the configuration with the smallest intrusiveness. In addition, different failure cases were investigated. For example, the influence on the stability and controllability of a damaged leading edge due to a bird strike was studied.



If necessary, a further low-speed wind tunnel test campaign will take place early next year to clarify final details. On the CFD side, additional simulations using a more detailed external geometry will be performed. The simulations will also be used to gain some additional insight into the results obtained during the ground effect tests in the wind tunnel (for example the effect of the floor boundary layer will be studied).



Recent Activities

Tests with Moving Models

A major strategic development of our facility in the last few years has been the experimental study – and the development of corresponding test equipment – of aerodynamics on a car carrying out quick changes in ride height as typically induced by driver inputs or uneven tracks. Next to a first commercial test, several other activities in this field can be reported. A test with an ellipsoid body using improved data processing algorithms in order to study the influence of the virtual mass as well as to gather experimental data to be compared with CFD data has been performed. An additional wind tunnel test successfully extended the operability of the shaker up to 40 Hz motion frequency in the AWTE.

First steps have also been taken to implement a real-time numerical simulation of a vehicle on a road using concurrently gathered experimental data of an accordingly positioned model in the wind tunnel. With such equipment, a simulated car can be driven through a course and at the same time the transient aerodynamic effects taking place on the car can be observed. Optimization goals, such as quickest driving time, easy handling, or minimal power requirements can be addressed over a particular stretch of a track, under almost real conditions, with different specific car settings – not only aerodynamic settings.

Aerocourse 2008

Under the guidance of distinguished experts from the automotive and race car industry and of in-house specialists with several years of experience in the field, RUAG Aerospace will hold a 4-day course on Aerodynamic Development of Race and Production Cars on October 27 to 31. The course will include lectures as well as practical work in the automotive wind tunnel (AWTE) in order to give the attendees a unique combination of theoretical background complemented by hands-on experience in a state-of-the-art facility.

Additional information can be found under www.aerocourse.ch

Publications

- M. Guillaume, Jan Vos, Alain Gehri, "Calculation of Unsteady Loads for the F/A-18 Vertical Tail Buffeting", 25. CADFEM User's Meeting 2007 in Dresden, Germany
- Peter Aschwanden, Jürg Müller, RUAG Aerospace, Gian Claudio Travaglio, Timo Schöning, GTV Fahrzeugdynamik GmbH, "The Influence of Motion Aerodynmics on the Simulation of Vehicle Dynamics", SAE 2008-01-0657
- Martin Monkewitz, Jürg Müller, "Measuring of Long Truck Models in a Wind Tunnel with External Balance", SAE 2008-01-1202

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