AFLoNext

2ND GENERATION ACTIVE WING

NEWSLETTER °1

February 2014

Welcome to the first newsletter from the AFLoNext project!

AFLoNext gathers forty European partners from fifteen countries for a period of four years, until May 2017. Our fundamental goal is to mature highly promising flow control technologies and to show their potentials for advanced eco-efficient aircraft design.

Our public newsletters will regularly keep you up-to-date on progress made within AFLoNext. Whats' more, you will be given a possibility to discover how the consortium partners cooperate to achieve the project objectives. You will also find out how and when we disseminate the AFLoNext results. This is in case you feel like meeting with us!

Word from the Coordinator

It is with great pride and enthousiasm that I present to you the AFLoNext project and its first Newsletter. We believe that AFLoNext will largely contribute to improve the environmental footprint of air transport by means of integrated flow control technologies in aircraft design.

AFLoNext brings together numerous partners across Europe each one contributing with high-level experience and capacities. Our consortium represents a truly good footprint through the continent and beyond.

I also invite you to visit the AFLoNext web-page (www.aflonext.eu) which is constantly kept up-to-date. A large space is dedicated to the Technology Trajectory. Feel free to inform us on any related publication, project or event which should be brought to the attention of the AFLoNext community.

I'm confident that the good team spirit and motivation to deliver the AFLoNext targets will accompany us all along the project!

Dr. Markus Fischer,
Overall Aircraft Aero Design
Aerodynamics Design Management
Airbus Operations GmbH

NEWS & EVENTS

Geza Schrauf, Airbus Operations GmbH, reminds in the paper « The need of Large-Scale HLFC Testing in Europe » the potential of Hybrid Laminar Flow to significantly reduce the fuel burn of transport aircraft.

>> Read more

AFLoNext presentation leaflet is now downloadable :

>> Download the pdf

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This project is supported by the European Community's Seventh Framework Programme for research, technological development and demonstration, under grant agreement n°604013.

Word from the Project Officer

The environmental goals of Europe's Vision for Aviation 'Flightpath 2050' are quite ambitious. The aim of AFloNext is to contribute significantly to achieving these goals by reducing aircraft drag and noise through flow control and laminar flow technologies. Within the Research Framework Programmes of the EU research activities on laminar flow, on noise and flow control have an impressive tradition of 25 years since with the ELFIN project the first joint European effort started in 1989. Since then numerous projects enhanced the knowledge and technology readiness in these areas. The BLADE programme of CLEAN SKY with an Airbus A340 flight test, the FP7 projects RECEPT on transition prediction and DESIREH on high-lift aerodynamics for laminar wings present the latest research activities in these fields. Their targets are to contribute by these technologies to substantial drag and noise reduction of the next airliner generation.

The AFloNext project has the potential to push the technology readiness level forward by its simulation and experiments that include even flight testing of the critical technologies. As the Scientific Officer of the European Commission for this project, I wish the entire AFloNext consortium good luck and success for its ambitious work.

Dietrich Knoerzer,
European Commission, DG Research & Innovation, RTD-H.3 – Aviation

ACTIVE FLOW CONTROL ON AIRFRAME

Main achievements have been so far:

- Definition of the baseline configurations (FNG and XRF1 models) and flow conditions for carrying out numerical simulations.
- Delivery of baseline geometries.
- State-of-the-art survey of related Active Flow Control (AFC) concepts.
- Provision of initial requirements for AFC technology, as well as the very first aspects of actuator integration.
- The reference a/c FNG model, considered for CFD (cf. Figure WP2-1), will be represented by the SADE model (cf. Figure WP2-2) for technology readiness testing in Wind Tunnel.
- Preparation of a Digital Mock-Up "DMU" of the SADE Wind Tunnel model, to ease the cooperation between partners dealing with AFC hardware integration.

SADE model in the WT

FNG in the WT set-up

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HYBRID LAMINAR FLOW CONTROL

The work on the Hybrid Laminar Flow Control (HLFC) fin has concentrated on the following items:

- First definition of the flight envelope for the HLFC system.
- Start of the design process based on a preliminary geometry of the A320 VTP and on the chamber layout for the two HLFC leading edges which will be tested within the German national HIGHER project in 2014.
- First issue of the surface quality requirements document.
- Start of compiling the requirements to obtain the "permit to fly."
- Setting up a group to prepare of the flight test with the A320 ATRA aircraft.

Main HLFC wing activities have been:

- Definition of a wing geometry representative for an outer wing of a long-range transport aircraft.
- Agreement between aerodynamics and structures on the design process and set up of a digital mock-up.
- Start of the work on the three different HLFC surface concepts:
  (a) based on superplastic forming,
  (b) based on a perforated porous composite with metallic erosion shield, and
  (c) based on metallic foam.
- Start of the space allocation study for Krueger flaps including two different deployment systems.

CONTROL MEANS FOR VIBRATION AND AEROELASTIC COUPLING

The geometry clean-up to get simpler geometrical shapes and watertight geometries for meshing and CFD calculations is ongoing and almost complete.

The meshing approach and number of meshes needed to satisfy the needs of all partners were also discussed and appropriate actions were placed. First numerical results on simplified aircraft geometries have been obtained by Kungliga Tekniska Högskolan and CFS Engineering SA, with the other partners following soon.

The following points have been discussed:

- FE model, which in the meantime, has been distributed.
- Dependencies between structural modelling and aerodynamical modelling.
- Flight test requirements, especially the GVT and FTI requirements.
- Draft FTR which is now available and will be detailed and completed in the next months.

Simulation of the flow field around the main landing gear door of an Airbus A320.

NOISE CONTROL ON AIRFRAME

For the landing gear activities, the noise reduction technologies to be applied on the ATRA aircraft have been defined and priorized. In parallel, the preparation of the CAD model for the planned CFD study on optimized flap settings to reduce the gear wake flap interaction and thus interaction noise has been conducted by Airbus Operations GmbH and Messier-Bugatti-Dowty SA. The CAD model consists of all major gear parts e.g. main leg, leg door, wheel set and side-stay, which are considered reasonable to conduct the CFD study.

The flap side edge activities were affected by a request of change which has been initiated end of September 2013. After its agreement by the consortium and the EC, the technical & design specifications for the planned wind tunnel tests had to be re-arranged. Now the D&M of a highly detailed A320 flap side edge (FSE) - to be used as reference - and one porous flap side edge (PFSE) to prove the low-noise capability is ongoing. The opportunity of a second PFSE geometry with bigger span wise extension of the porous material has been considered and is currently taken into account by a modular model design. The wind tunnel test in the AWB at DLR in Braunschweig/Germany is scheduled for May 2014.

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MULTIFUNCTIONAL TRAILING EDGE CONCEPTS

Taking into account the large number of partners, performing numerical simulations, it was decided to conduct a benchmark exercise to compare CFD results provided by different methods, strategies and codes, for both: flow control via micro-circulation concept and buffet control via fluidic Trailing Edge Devices "TED". For this latter, two experimental databases were selected from two test campaigns performed in the framework of the EU FP6 AVERT "Aerodynamic Validation of Emission Reducing Technologies" project:

- The first one had been done at Vyzkumny A Zkusebni Letecky Ustav A.S. A4 test section transonic facility using an existing ONERA 2D OAT15A aerofoil;
- The second test campaign was carried out at the ONERA S2MA high speed wind tunnel using a 3D half fuselage-Wing model. The cost of these demonstration tests were shared between Airbus Operations Ltd, Airbus Operations SL, Alenia Aeronautica, Dassault-Aviation and ONERA.
- A technical note describing the numerical benchmark AVERT database has just be issued mid-January 2014 by ONERA and Vyzkumny A Zkusebni Letecky Ustav A.S. ONERA has also released to the partners the available data.
- Experiments performed at Tel Aviv University focus on two aspects: (i) wind tunnel baseline tests of a candidate airfoil that is suitable for installation of TE devices due to its relative thick TE region and (ii) bench top tests aimed at establishing a correlation between jet in cross flow and CFD simulations on the complete airfoil.
- Preliminary results indicate a good correlation between the bench top steady jets and CFD on the airfoil.
- Additional results link the performance of unsteady wall normal jet in cross flow to its steady counterpart. This will enable to link measured effects of unsteady actuation to steady CFD on the airfoil, providing prediction to the unsteady effects on a complete airfoil.
- Wind tunnel experiments are under preparations for steady jet in cross flow over the airfoil at Re=1M.

GET-TOGETHER

AVIATION 2014 — 16-20 June 2014

The AIAA Aviation and Aeronautics Forum and Exposition is organised in **Atlanta, Georgia, USA**. Through cutting-edge technical research presentations and detailed technical panel discussions, AVIATION 2014 is to provide a wide-ranging overview of the state-of-the-art in the aeronautics industry. Source:http://www.aiaa.org/aviation2014/

ACTUATOR 2014 — 25 june 2014

The 14th International Conference and Exhibition on New Actuators organised in **Bremen, Germany,** will surely interest you in the transfer of R&D results into innovative actuator applications and drive technologies. Source: http://www.actuator.de/

WCCM XI, ECCM V, ECFD VI — 20-25 July 2014

IACM and ECCOMAS are jointly organising the 11th World Congress on Computational Mechanics (WCCM XI), the 5th European Conference on Computational Mechanics (ECCM V) and the 6th European Conference on Computational Fluid Dynamics (ECFD VI) in **Barcelona, Spain**. Source: http://www.wccm-eccm-ecfd2014.org/frontal/default.asp

ICAS — 7-12 September 2014

ICAS, the International Council of the Aeronautical Sciences, organizes every two years an International Congress covering all aspects of aeronautical science and technology and their application to both military and civil aviation. The ICAS 29th Congress will take place for the first time in **Russia, in Saint Petersburg.** We have the pleasure to announce that one of the AFLoNext partners, TsAGI, is the organizer of the ICAS-2014.Source: http://www.icas2014.com/

DGLR — 16-18 September 2014

The German Air and Space Congress 2014 will take place in **Augsburg, Germany**. The 2014 Congress motto is "Aerospace - drive to new horizons". A special topic will relate to "synergies between automotive and aerospace" covering such categories as Safety, Environment and Certification, Embedded Systems and Software, production technologies and more. Call for papers is ongoing. Source: http://www.dlrk2014.dglr.de/

EASN workshop on Flight Physics — 27-29 October 2014

The 4th EASN Association Internationyal Workshop on Flight Physics and Aircraft Design will take place in **Aachen, Germany**. Source:http://workshop.easn-tis.com/

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INTERVIEW

AFLoNext newsletters offer you the possibility of getting to know some of the project partners a little better… Thus, the Interviews section will let you discover the day-to-day life of the people involved in achieving the AFLoNext goals.

In this edition of the AFLoNext Newsletter # 1, we propose you several tags which will lead the interview: **application – investigations – benefits**.

PROF. AVRAHAM SEIFERT

Head of Meadow Aerodynamics laboratory at Tel Aviv University, Israel

Q1: Tel Aviv University has recently purchased a 3D prototyping machine. Could you please tell us how you envisage exploiting the machine's potential within AFLoNext? What was your motivation and what is the planned application?

A1: TAU is actually in the possession of more than one 3D printer. We have a range of machines one made by Stratasys (formerly the Israeli company Objet) which has a range of materials and a resolution of about 0.1mm, and a few simpler machines with poorer resolution of about 0.5mm. The machines differ in the print time, the finalization process, the surface quality and certainly by the material cost. The main benefit of the 3D printing machines is the capability to make complex parts that would be extremely complex, time consuming and costly to fabricate otherwise.

In the images below you can see parts made for adapting the TAU developed Suction and pulsed blowing actuator to fit inside an existing aerofoil that was used previously for separation control studies. Another picture shows the upper surface of the airfoil with an array of SaOB actuators housed under the surface, and the suction holes and pulsed blowing slots clearly visible. Making these parts from conventional machining would have cost 10 times more and last at least 10 times longer. The student working on this project, Dima Sarkorov designed all these parts using a CAD software package and downloaded an STL file directly to the machine which gave Mr. Sarkorov great flexibility in designing complex shapes.

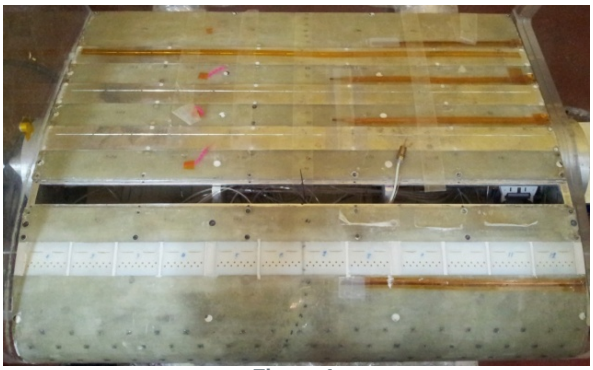

Figure 1

Q2: At what stage of the project will the machine contribute to the AFLoNext investigations?

A2: The machines already contribute significantly to the progress of two tasks, as part of WP 2 and WP 5, TAU is involved in. In WP5, for instance, the student working on the project, Danny Dolgopyat, in the effort to miniaturize his version of the SaOB actuator to fit into the thin trailing edge region of an aerofoil, printed several versions. Eventually we reached the conclusion that we have to resort back to conventional CNC milling since details smaller than 0.1mm were needed. So one does not need to expect 3D will replace conventional milling techniques, though it is a great prototyping tool. Therefore, the nozzles, connection and cover parts to the small SaOB system probably will be made in the 3D printer technology. This can be shown in the example below, where we have "printed" an early version of a slat intended to be used in AFLONEXT.

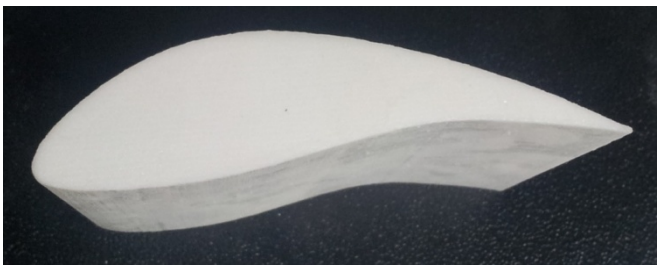

Figure 2

Q3: What are the expected benefits of using a 3D approach within AFLoNext?

A3: The expected benefits are the ability to make very complicated shapes in significant short time and cost savings and therefore the capability to reach the project goals with higher certainty, and I might say with less anxiety.

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