53rd 3AF International Conference on Applied Aerodynamics
Multiphysics approach in aerodynamics
Salon-de-Provence, March 26-27-28, 2018

http://3af-aerodynamics2018.com

Unsteady aeroelasticity © CReA - ISAE-SUPAERO
Scientific Committee

Thierry ALZIARY de ROQUEFORT
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Christophe SICOT
Philippe SPALART
Jean TENSI

ISAE-ENSMA (retired)
University of Cambridge
University of Paris West
ISAE-SUPAERO
University of Poitiers
ISAE-ENSMA
IMFT
ArianeGroup
ONERA
Safran Aircraft Engines
ISAE-SUPAERO
ONERA
Airbus
ONERA
Arts et Métiers ParisTech
ArianeGroup
École Centrale de Lyon
ONERA
ISAE-SUPAERO
Airbus
3AF and ONERA
University of Orléans
Polish Academy of Sciences
Safran Aircraft Engines
ONERA
MBDA
Renault (retired)
ISL
City, University London
IAT – CNAM
PSA Peugeot Citroën
University of Strasbourg
École Centrale de Lyon
DGA (French Procurement Agency)
University of Orléans
Institut ICARE
CNES
3AF
ArianeGroup
MBDA
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Safran Aircraft Engines
French Air Force Academy
Dassault Aviation (retired)
ONERA
ONERA
Dassault Aviation
Texas A&M University
ONERA
CNRS (retired)
ISAE-ENSMA
Boeing Commercial Airplanes
3AF
Multiphysics approach in aerodynamics

The 3AF International Conference on Applied Aerodynamics is organized each year by the French Aeronautics and Astronautics Society (3AF) in a different venue in France known for its activities in the field of aeronautics and/or space technology. The conference is an excellent opportunity for scientific exchanges within the aerospace community where aerodynamicists from industry, research institutions and academia meet. Scientists and engineers from other fields involving fluid mechanics are also welcome.

Every year the conference addresses a different topic trending in the field of aerodynamics. It is organized on the basis of five half-days of technical presentations, each introduced by a keynote conference given by a highly recognized expert in the field covered during the session. The conference is concluded by a technical visit in connection with the conference subject.

In 2018, the conference is hosted by the French Air Force Academy at Salon-de-Provence.

This 53rd 3AF International Conference on Applied Aerodynamics is aimed at bringing together a diverse range of disciplines, which have strong coupling with aerodynamics during design and optimization. Aerodynamics remains one of the major design drivers in aerospace and the overall transportation industry, but the way the industry has reshaped recently has urged us to consider a multiphysics approach in order to address environmental and sustainability issues, and open up new frontiers in hypersonic speed journeys. This also has the added benefit of reducing the number of design iterations and shortening the design cycle. Therefore deeper knowledge of the multidisciplinary field such as fluid and structure interaction, acoustics, thermodynamics, heat transfer and many others is required.

This conference is a platform for researchers from a diverse range of disciplines to get together and discuss the challenges that the aerodynamics community currently faces, while finding common grounds encouraging further collaborations.

The conference welcomes contributions from experimental, theoretical and numerical studies dealing with both fundamental and applied research.

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**MONDAY, MARCH 26, 2018**

08:00  Registration & Welcome Coffee
09:00  Conference Welcome
09:30  Keynote Conference n°1: Demetrios Papageorgiou (Imperial College)
10:15  Session n°1a: Multiphysics CFD and optimisation / Session n°1b: CFD Methodology
14:45  Keynote Conference n°2: Piergiovanni Renzoni (CIRA)
15:30  Session n°2a: Icing and heat transfer / Session n°2b: Aerodynamics and actuators
18:45  Welcome Cocktail

**TUESDAY, MARCH 27, 2018**

09:00  Keynote Conference n°3: Frédéric Guntzer (Airbus Helicopters)
09:45  Session n°3a: Aeroacoustics / Session n°3b: Structure, fluid and flight mechanics
14:45  Keynote Conference n°4: Eric Garrigues (Dassault Aviation)
15:30  Session n°4a: Aeroelasticity / Session n°4b: Other applications
20:00  Awards of the 3AF International Conference on Applied Aerodynamics and Banquet

**WEDNESDAY, MARCH 28, 2018**

08:45  Keynote Conference n°5: Olivier Chazot (VKI)
09:15  Session n°5a: Reactive flows and plasmas / Session n°5b: Multidisciplinary analysis
14:30  Technical visits
Monday, March 26, 2018

ROOM 1

08:00 REGISTRATION

09:00 CONFERENCE WELCOME
Michel Scheller (President, 3AF)
Général Eric Autellet (French Air Force Academy Commandant)

09:30 KEYNOTE CONFERENCE N°1:
Droplet impact and splash-off in aerodynamic applications
Demetrios Papageorgiou (Imperial College)

ROOM 1

Session n° 1a: Multiphysics CFD and optimisation
Chairperson: Doyle Knight
(Rutgers University)

10:15 ECOGEN, an opensource tool dedicated to multiphase compressible multiphysics flows
K. Schmidmayer, A. Marty, F. Petitpas and E. Daniel
(IUSTI-CNRS, California Institute of Technology)

10:45 Advanced numerical simulation in CFD and multiphysics at ONERA; issues, results and strategy
L. Cambier (ONERA)

COFFEE BREAK

11:45 Fast multidisciplinary optimization of a MAV propeller for noise reduction: from simulation to experimentation
C. Nana, Y. Mériblac and R. Serré
(Altran/ISAE-SUPAERO)

12:15 Development of a 3D CFD aerodynamic optimization tool and application to engine air intake design optimization
G. Milot, O. Scholz, S. Ouhamou, M. Becquet and S. Magnabal (Altran)

LUNCH

Particle emission due to train braking © ESTACA
14:45 KEYNOTE CONFERENCE N°2: Aircraft in-flight icing research at CIRA, 25 years at the service of aviation safety
Piergiovanni Renzoni (CIRA)

ROOM 1

15:30 A Level-Set based multi-step icing modelling in the NSMB solver
A. Al-Kebsi, Y. Hoarau and R. Mosé (ICube Laboratory)

16:00 Prediction of airfoil performance degradation due to ice accretion
M. Costes and F. Moens (ONERA)

16:30 COFFEE BREAK

17:00 Numerical methods for heated and unheated supersonic jets
J. Trümner and C. Mundt (Universität der Bundeswehr München)

17:30 Use of numerical simulation to enhance the design of high temperature probes utilized for gas analysis during combustion chamber testing
E. Jérôme, C. Nicole and C. Casteloot (DGA Aero-Testing Engines)

18:00 A numerical investigation of effect of expansion on highenthalpy nitrogen flow over a double wedge at Mach 7
A. Khraibut and S. L. Gai (University of New South Wales)

18:45 WELCOME COCKTAIL - Hosted by Ecole de l’Air (French Air Force Academy)

ROOM 2

15:30 Interaction between a jet and a turbulent boundary layer: experimental setup
C. Ott, Q. Gallas, J. Delva and L. Keirsbulck (ONERA/Université de Valenciennes)

16:00 Airfoil drag reduction by active control of trapped vorticity concentrations
M. E. DeSalvo and A. Glezer (Georgia Institute of Technology)

17:00 Manipulation of a 3D bluff body asymmetric wake flow by means of rear perimetric slit blowing

17:30 Transonic performance of airfoils using leading edge tubercles
A. Asghar, R. E. Perez and M. Ferchichi (Royal Military College of Canada)

18:00 Numerical investigation of a turbulent flow generated by lobed jets
K. Boualem, M. Bouchouicha Seddik, T. Yahiaoui and A. Azzi (Sciences and Technology University of Oran)
9:00 KEYNOTE CONFERENCE N°3:
Industrial stakes in helicopter aeroacoustics
Frédéric Guntzer (Airbus Helicopters)

Session n°3a:
Aeroacoustics
Chairperson: Denis Gély
(Onera)

09:45 Slat broadband noise prediction of multi-element 30P30N airfoil by a hybrid RANS-LES method
T. Peng, Y. Yao and Q. Zhu
(University of the West of England)

10:15 Flow and acoustic noise control via trailing-edge flaplets
E. Talboys, C. Brücker, T. Geyer and E. Sarradj
(City University London/Brandenburg University of Technology Cottbus)

10:45 Aeroacoustics investigation of a harmonically morphing trailing edge flap
C. Abdessemed, Y. Yao, A. Bouferrouk and P. Narayan
(University of the West of England)

11:15 COFFEE BREAK

11:45 Electroactive morphing on a supercritical wing targeting improved aerodynamic performance and flow control in high Reynolds numbers
N. Simiriotis, G. Jodin, A. Marouf, Y. Hoarau, J.F. Rouchon and M. Braza
(IMFT/Laplace Institute/LMFA)

12:15 Correlations between density fluctuations and acoustic far field in free jets using Rayleigh scattering
B. Mercier, E. Jondeau, T. Castelain and C. Bailly
(Ecole Centrale de Lyon/LMFA)

12:45 Aeroacoustics and limit cycle approach for early prediction of pressure oscillation amplitudes inside solid rocket motors
J. Collinet and L. Hirschberg (ArianeGroup)

13:15 LUNCH
<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
<th>Authors/Institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>14:45</td>
<td><strong>KEYNOTE CONFERENCE N°4:</strong> A review of industrial aeroelasticity practices for military aircraft and business jets</td>
<td>ROOM 1</td>
<td>Eric Garrigues (Dassault Aviation)</td>
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<tr>
<td>15:30</td>
<td><strong>Session n°4a:</strong> Aeroelasticity</td>
<td>ROOM 1</td>
<td>H. Bdeiwi, A. Ciarella, M. Hahn and A. Peace (Aircraft Research Association)</td>
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<tr>
<td>16:00</td>
<td>Computation of very flexible high-aspect-ratio composite wing flutter speed using optimised open source solver</td>
<td>ROOM 1</td>
<td>B. Kirsch, O. Montagnier, E. Bénard and T. Faure (CReA French Air Force Research Center/Université Aix-Marseille/ISAE-SUPAERO)</td>
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<tr>
<td>16:30</td>
<td><strong>COFFEE BREAK</strong></td>
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<tr>
<td>17:00</td>
<td>Fluid-structure interaction between a composite aileron and a turbulent flow at transonic conditions</td>
<td>ROOM 1</td>
<td>J. Dumon (ISAE-SUPAERO)</td>
</tr>
<tr>
<td>17:30</td>
<td>Local contribution of blades vibration on the choke flutter instability in transonic UHBR fan</td>
<td>ROOM 2</td>
<td>F. Duquesne, Q. Rendu, P. Ferrand and S. Aubert (LMFA)</td>
</tr>
<tr>
<td>18:00</td>
<td>Fluid-structure interaction between a composite aileron and a turbulent flow at transonic conditions</td>
<td>ROOM 2</td>
<td>A. Ebrahimi, M. Hajipour and K. Ghamkhar (Sharif University of Technology)</td>
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<td>18:00</td>
<td>Local contribution of blades vibration on the choke flutter instability in transonic UHBR fan</td>
<td>ROOM 2</td>
<td>J. Chen, X. Nie and X. Zhou (Beijing Implant Aircraft)</td>
</tr>
<tr>
<td>18:00</td>
<td>Modeling a supersonic flow around a dihedral airfoil</td>
<td></td>
<td>A. Naamane, M. Hasnaoui and S. Ravard (Royal Moroccan Air Force Academy/ENSAM/French Air Force Academy)</td>
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<td>20:00</td>
<td><strong>AWARDS &amp; BANQUET</strong></td>
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### KEYNOTE CONFERENCE N° 5:
Testing strategy for aerothermodynamic design in high-enthalpy and plasma wind tunnels
Olivier Chazot (VKI)

#### ROOM 1

**09:15**
**Session n°5a:**
Reactive flows and plasmas
*Chairperson: Christian Mundt*
(Université der Bundeswehr München)

- Experimental investigations of flow control by plasma actuators with the hypersonic rarefied wind tunnel MARHY: Mach 20.2 case
  R. Joussot, S. Coumar and V. Lago (ICARE Laboratory)

- Specific enthalpy and heat flux measurements in the arc-jet supersonic low pressure wind tunnel PHEDRA
  V. Lago and R. Joussot (ICARE Laboratory)

**10:15**
**Simulation of impinging under-expanded gas jets into liquid**
F. Chen, A. Allou and J.-D. Parisse
(CEA/French Air Force Academy)

#### ROOM 2

**09:15**
**Session n°5b:**
Multidisciplinary analysis
*Chairperson: Eric Daniel*
(IUSTI-CNRS)

- Contributions of fluid mechanics to aesthetic-functional nose surgery
  T. Radulesco, J. Michel, L. Meister, G. Bouchet, J. Giordano, P. Perrier and P. Dessi (IUSTI-CNRS)

- Shockporation: human cells transfection induced by shock wave interaction: study of transfection mechanisms
  N. Gaci, D. Normano, J. Deschamps, P. Perrier, M. Modesti and J. Giordano (IUSTI-CNRS/IRPHE/CRCM)

**10:15**
Development of CFD methodology for drainage design in nacelle compartment
B. Michel, N. Nony and Y. Sommerer
(Altran/Airbus Operations)

#### COFFEE BREAK

**11:00**
Prediction of aerothermodynamic loading in hypersonic shock-wave/laminar-boundary layer interaction
D. Knight and N. Kianvashrad (Rutgers University)

**11:30**
Investigation of a scramjet flowfield with hyperspectral imaging augmented by large eddy simulation
K. Gross, J. Komives, A. Kerst and E. Oren
(US Air Force Institute of Technology)

**12:00**
Reactive hypersonic flows computed with detailed chemical kinetics models
M-C. Druguet, A. Bultel, V. Morel and J. Annaloro
(IUSTI/CORIA/ISAE-ENSMA/CNES)

**12:30**
Reactive hypersonic flows computed with detailed chemical kinetics models
M. Hasnaoui, A. Naamane and E. Lahmad
(ERA/EMI/ENSAM)

**14:30**
**TECHNICAL VISITS**
The conference will take place in the **Ecole de l’Air (French Air Force Academy)**

**Getting to Conference Location**

**Ecole de l’Air (French Air Force Academy)**
Base Aérienne 701 – Chemin de Saint Jean
13661 Salon-de-Provence (France)

Please be aware that the access to the Military Base is strongly limited. Don’t forget to bring your ID each morning.

**Access by train**

The closest train station is “Aix-en-Provence TGV”. A shuttle will be organized on Sunday 25th evening to the selected hotels.

For more information: [https://en.oui.sncf/en/](https://en.oui.sncf/en/)

**Access by plane**

The closest airport is “Marseille – Provence Airport”. A shuttle will be organized on Sunday evening to the selected hotels.

For more information: [www.marseille-airport.com](http://www.marseille-airport.com)

**Conference Shuttle**

A dedicated shuttle is organized from city center and near the Military Base every morning.

The detailed schedule is available online [www.3af-aerodynamics2018.com](http://www.3af-aerodynamics2018.com) and at the Welcome Desk.

**Technical visits scheduled on Wednesday, March 28, 2018**

3 technical visits are proposed in the framework of the AERO2018 Conference to the pre-registered participants, going the opportunity to discover the following facilities on Military Base:

- **Patrouille de France Hall**: visit of the sheds and meeting with pilots and mechanics

- **CFAMI (Centre de Formation Aéronautique Militaire Initiale)**: visit and introduction to the center, ending by a presentation of a static plane

- **ONERA**: presentation of the research units (Radar · Optronics · Helicopters · IHS) and visit of laboratories (integration hall, simulation lab, plane-lab)

Participants willing to take part in these visits must therefore be pre-registered and also provide an identity document prior to the visits.

For the visits, in order to take place in the best conditions, the total number of participants is limited to about 30 people who will be divided into 3 groups.
53rd 3AF International Conference on Applied Aerodynamics Salon-de-Provence, March 26-27-28, 2018

CONFERENCE VENUE
École de l’Air (French Air Force Academy) Base aérienne 701 - Chemin de Saint-Jean 13661 Salon-de-Provence

LANGUAGE
Official language for the conference is English.

REGISTRATION
Delegates including Chairpersons and Speakers are requested to register and settle registration fees prior the conference. Access to technical visit is controlled for security reasons.

Registration fees include: Conference session attendance, Conference documentation, coffee breaks, lunches, banquet on Tuesday, March 27, 2018, access to the technical visit and Conference proceedings.

All prices quoted are in EURO. Registration fees not subject to VAT.

3AF Individual Member € 650.00
Speaker/Chairpersons € 650.00
Participant € 900.00
Academics/Student/PhD € 400.00
Additional conference banquet ticket for accompanying person € 60.00

REGISTRATION FORM AND PAYMENT
On line registration on: http://3af-aero2018.evenium.net

Complete online form and follow payment indication. Upon receipt of your payment an invoice and a recipe will be sent. These are to be shown at the Conference Welcome Desk.

CANCELLATION POLICY
At less than 7 days from the conference, a € 350 cancellation fee will apply to participants, speakers and chairpersons, € 250 to Academics / students / PhD.

Delegates who do not cancel before the start of the conference will be liable to the full registration fee.

PUBLICATION
Authors of the best papers will be invited current April to propose an extension of their works for publication in a special issue of the International Journal of Numerical Methods for Heat & Fluid Flow* dedicated to the conference. These extended versions must be original, written according to the journal’s standards and submitted online** before May 31, 2018. Each paper is reviewed by the guest-editor and, if it is judged suitable for publication, is sent to at least two independent referees for double blind peer review.

*IJNMHFF, Impact Factor: 1.399, 2014; Journal Citation Reports®, Thomson Reuters, 2015)
http://emeraldgrouppublishing.com/products/journals/journals.htm?id=hff - **http://mc.manuscriptcentral.com/hff#sthash.w1PkH6Vd.dpuf

SECRETARIAT
For more information please contact:
3AF Executive Secretariat - 6, Rue Galilée – 75016 Paris, France - Fax: +33 (0)1 56 64 12 31
Anne Venables - E-mail: secr.exec@aaaf.asso.fr – Phone: +33 (0)1 56 64 12 30
Aude Lurbe - E-mail: aude.lurbe@aaaf.asso.fr – Phone: +33 (0)1 56 64 12 37

Make your reservation as soon as possible.

Dedicated shuttles are available from city center and close to the Military Base.
Special rates are negotiated with the following hotels:

> Hotels close to the Military Base

B&B Hôtel Salon de Provence **
Route d’Aix en Provence
13300 Salon de Provence
08.92.70.22.09
bb_4515@hotelbb.com

Campanile Salon de Provence ***
994, Chemin de la Croix Blanche
13300 Salon de Provence
04.90.42.14.14
salondeprovence@campanile.fr

Hôtel Ibis Salon de Provence Sud ***
752, Avenue du 18 Juin 1940
13300 Salon de Provence
04.90.42.23.57
h0797@accor.com

> Hotels in Salon-de-Provence City Center

Grand Hôtel de La Poste **
1, Rue des Frères Kennedy
13300 Salon de Provence
04.90.56.01.94
info@ghpsalon.com

Hôtel de Provence
450, Boulevard Maréchal Foch
13300 Salon de Provence
04.90.56.27.04
contact@hotelsalondeprovence.fr

Please contact the Executive Secretary for more information: Anne Venables
Tél +33 (0)1 56 64 12 30
secr.exec@aaaf.asso.fr
In the mid 1980s Europe’s main professional aerospace societies, after having individual members, will manage the activities. Committees with individual members and will be coordinated by a director who chaired by relevant professionals. These branches will be composed by technical apart from the consideration of CEAS as an association of national Societies, was necessary which would provide CEAS with a legal status and more flexible Confederation to Council took place in 2003 with the intention of providing improved collaboration, legal status and use of the resources of the constituent Societies. This culminated in the formation of the Confederation of European Aerospace Societies (CEAS) during the 1992 Farnborough Airshow and the official signing of the CEAS Constitution at the 1993 Paris Airshow. Later on, in 2003, the Constituent Societies realized that a deeper collaboration is formed in 1993 as the Confederation of European Aerospace Societies in recognition of the increasingly international nature of the aerospace business. The transition from Confederation to Council took place in 2003 with the intention of providing improved collaboration, legal status and use of the resources of the constituent Societies. The Royal Aeronautical Society is “the one multidisciplinary professional institution dedicated to the global aerospace community”. The RAeS is the world’s only professional body which caters for the entire aerospace community. Throughout the world’s aerospace community the name of The Royal Aeronautical Society is both well-known and well respected. The Royal Aeronautical Society has a range of Specialist Interest Groups, covering all aspects of the aerospace world, serving the interests of enthusiasts and industry professionals alike.

Through their conferences and lectures, the Groups consider significant developments in their field, stimulate debate and facilitate action on key industry issues, reflecting the constant innovation and progress in aviation. In addition, the Groups, acting as focal points for all enquiries, form a vital interface between the Society and the world at large.

The activities of the Aerodynamics Group cover a wide range of topics of interest to industry, research establishments and universities. Several members of the group have been active in the creation of the TSB funded UK Aerodynamics Centre. The wind tunnel facility review initiated by the Group has been taken up by the Aero Centre. The Group is trying to work more closely with the AIAA and the AIAA Applied Aerodynamics Technical Committee. The Group organizes a regular Applied Aerodynamics Conference as well as hosting the Lancaster Named Lecture.

Our promise is to be your vital lifelong link to the aerospace industry and a champion for its achievements.

One Remarkable Fact Says It All: Since 1963, members from a single professional society have achieved virtually every milestone in modern American flight. That society is the American Institute of Aeronautics and Astronautics. With more than 35,000 individual members and 100 corporate members, AIAA is the world’s largest technical society dedicated to the global aerospace profession. Created in 1963 by the merger of the two great aerospace societies of the day, the American Rocket Society (founded in 1930 as the American Interplanetary Society), and the Institute of the Aerospace Sciences (established in 1933 as the Institute of the Aeronautical Sciences), AIAA carries forth a proud tradition of more than 80 years of aerospace leadership.

This is the place for everything, from exploring our history and purpose … to catching up on the latest news … Make sure you check out our prestigious Honors & Awards programs. Recognizing excellence is one the most important contributions we make. Serving this elite audience and its historic mission is our commitment and our privilege. Now we invite you to learn more about AIAA — and share in the vision and excitement of this inspiring industry.

The Council of European Aerospace Societies was formed in 1993 as the Confederation of European Aerospace Societies in recognition of the increasingly international nature of the aerospace business. The transition from Confederation to Council took place in 2003 with the intention of providing improved collaboration, legal status and use of the resources of the constituent Societies.

In the mid 1980s Europe’s main professional aerospace societies, after having had bilateral exchanges for a long time, recognized the increasingly international nature of aerospace business and the strength of European industrial alliances by beginning to develop close working relationships.

This culminated in the formation of the Confederation of European Aerospace Societies (CEAS) during the 1992 Farnborough Airshow and the official signing of the CEAS Constitution at the 1993 Paris Airshow.

Later on, in 2003, the Constituent Societies realized that a deeper collaboration was necessary which would provide CEAS with a legal status and more flexible resources. The new status transferred in 2006 the former Confederation into a Council and gave CEAS legal support under the Belgian law.

Apart from the consideration of CEAS as an association of national Societies, two branches have been established: one for aeronautics and one for space chaired by relevant professionals. These branches will be composed by technical committees with individual members and will be coordinated by a director who will manage the activities.

Today CEAS comprises fifteen member societies with a combined roughly 35,000 individual members.
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**MONDAY 26 MARCH**
- Conference Welcome
- Session n°1a: Multiphysics CFD and optimisation
- Lunch

**TUESDAY 27 MARCH**
- Conference Welcome
- Session n°2a: Icing and heat transfer
- Session n°3a: Aeroacoustics
- Lunch
- Session n°3b: Structure, fluid and flight mechanics

**WEDNESDAY 28 MARCH**
- Conference Welcome
- Session n°4a: Aeroelasticity
- Lunch
- Session n°4b: Other applications
- Session n°5a: Reactive flows and plasmas
- Lunch
- Session n°5b: Multidisciplinary analysis

**TECHNICAL VISIT**
- 1/ Patrouille de France Hall
- 2/ CFAMI (Centre de Formation Aéronautique Militaire Initiale)
- 3/ ONERA

**AWARD AND BANQUET**
- Welcome Cocktail

**END OF CONFERENCE**