The Quarterly Bulletin of the

CEAS

COUNCIL OF EUROPEAN AEROSPACE SOCIETIES

3AF AIAE AIDAA AAAR CzAeS DGLR FTF HAES NVvL PSAA RAeS SVFW TsAGI

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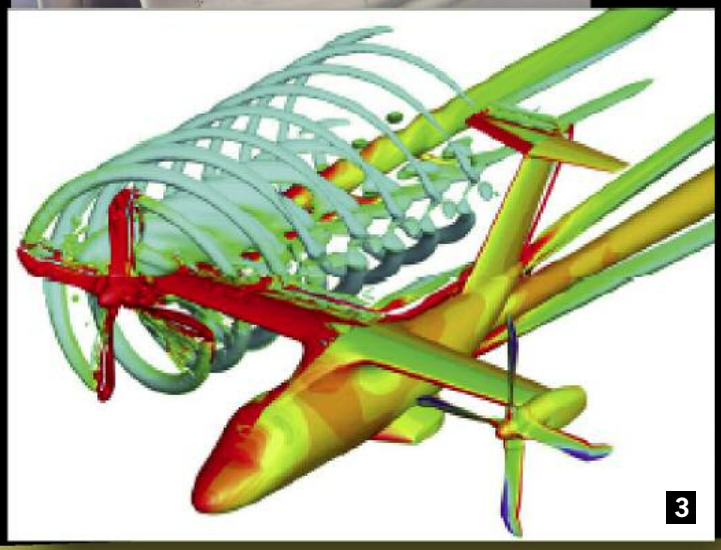

AMONG TOPICS

WHAT IS CEAS ?

The Council of European Aerospace Societies (CEAS) is an International Non-Profit Association, with the aim to develop a framework within which the major Aerospace Societies in Europe can work together.
It presently comprises thirteen Full Member Societies: 3AF (France), AIAE (Spain), AIDAA (Italy), AAAR (Romania), CzAeS (Czech Republic), DGLR (Germany), FTF (Sweden), HAES (Greece), NVvL (Netherlands), PSAA (Poland), RAeS (United Kingdom), SVFW (Switzerland), TsAGI (Russia); and six Corporate Members: ESA, EASA, EUROCONTROL, LAETA, VKI and EUROAVIA..
Following its establishment as a legal entity conferred under Belgium Law, this association began its operations on January 1st, 2007.
Its basic mission is to add value at a European level to the wide range of services provided by the constituent Member Societies, allowing for greater dialogue between the latter and the European institutions, governments, aerospace and defence industries and academia.
The CEAS is governed by a Board of Trustees, with representatives of each of the Member Societies.

Its Head Office is located in Belgium:
c/o DLR – Rue du Trône 98 – 1050 Brussels.
www.ceas.org

WHAT DOES CEAS OFFER YOU ?

Knowledge transfer:

- A well-found structure for Technical Committees

High-Level European Conferences:

- Technical pan-European events dealing with specific disciplines and the broader technical aspects
- The CEAS European Air and Space Conferences: every two years, a Technical oriented Conference, and alternating every two years also, a Public Policy & Strategy oriented Conference

Publications:

- Position/Discussion papers on key issues
- CEAS Aeronautical Journal
- CEAS Space Journal
- CEAS Quarterly Bulletin

Relationships at a European Level:

- European Commission
- European Parliament
- ASD (AeroSpace and Defence Industries Association of Europe), EASA (European Aviation Safety Agency), EDA (European Defence Agency), ESA (European Space Agency), EUROCONTROL
- Other European organisations

European Professional Recognition:

- Directory of European Professionals

Honours and Awards:

- Annual CEAS Gold Medal to recognize outstanding achievement
- Medals in technical areas to recognize achievement
- Distinguished Service Award

Young Professional Aerospace Forum

Sponsoring

THE CEAS MANAGEMENT BOARD

It is structured as follows:

- General Functions: President, Director General, Finance, External Relations & Publications, Awards and Membership.

- Two Technical Branches:
  – Aeronautics Branch
  – Space Branch

Each of these two Branches, composed of specialized Technical Committees, is placed under the authority of a dedicated Chairman.

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EDITORIAL

TEN YEARS ALREADY!

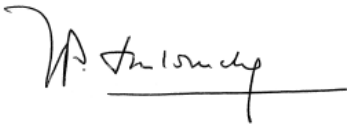
Jean-Pierre Sanfourche
Editor-in-Chief,
CEAS Quarterly Bulletin

On 6 December 2006 the inaugural General Assembly of the Council of European Aerospace Societies (CEAS) took place in Brussels, so ten years exactly from now. It was announced that following its establishment as a legal entity conferred under Belgium Law and the approval of the Statutes at the General Assembly, the new organisation would begin its operations on 1st January 2007 and would be headquartered at the Brussels offices of the DLR. The eight founding members were: AAAF (France), AIAE (Spain), AIDAA (Italy), DGLR (Germany), FTF (Sweden), NVvL (The Netherlands), RAeS (United Kingdom) and SVFW (Switzerland).

Sir Colin Terry (UK) was elected as the first President of this institution and declared in the editorial of the issue 1-2007 of our Quarterly Bulletin:
" *[...] I am sure that all would agree that the official formation of the Council is a major step forward for greater co-operation in one of Europe's leading industries and without doubt one where Europe is a world leader in many aspects of the Science, Engineering and Technology of Aeronautics and Astronautics.*"

This Council had not been created *ex nihilo* but was in fact the result of a slow evolution of the Confederation of European Aerospace Societies which was born fifteen years ago on the occasion of the Farnborough International Air Show 1992[1]. Composed at that time of four associations only - AAAF, AIDAA, DGLR and RAeS – it rapidly grew up to eight by the integration of AIAE and NVvL in 1994, then FTF and SFFW in 1996. It was decided as early as 2003 to undertake the process of statute evolution from "Confederation" to "Council" in order to strongly mark the intention to become a more efficient European Aerospace Knowing Society, process which reached conclusion in the end of 2006.

Effectively since 1st January 2007, under the very dynamic management of its successive presidents – Sir Colin Terry in 2007, Georges Bridel in 2008-2009, Joachim Szodruch in 2010 – Pierre Bescond in 2011-2012, David Marshall in 2013 and Fred Abbink in 2014-2015-2016 – the CEAS has regularly grown, counting now 13 full Member Societies, 6 Corporate Members as well as 7 Institutions with which it is in relation through a Memorandum of Understanding, created two Science & Technology publications – CEAS Aeronautical Journal and CEAS Space Journal – and held 5 high-level Air & Space Conferences (Berlin 2007, Manchester 2009, Venice 2011, Linköping 2013 and Delft 2015).
Unquestionably in ten years, the "Council" CEAS has reached notoriety.
The road in front of us is clearly defined: consolidate the acquired attainments and endless improve the quality of our products, most notably the biennial Conference and the CEAS Journals. There is no doubt that our new President Christophe Hermanns will successfully take up the challenge.



1. Note: The "Confederation" CEAS is 25 years old whilst the "Council" CEAS is 10 years old. A brochure relating the CEAS history will be published in 2017 on the occasion of the 25th Anniversary of the "Confederation" CEAS.

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CEAS PRESIDENT'S MESSAGE

Fred Abbink, CEAS President

THE 37th BOARD OF TRUSTEES MEETING HELD IN LONDON ON 29 NOVEMBER DEALT WITH MANY TOPICS

On 29 November 2016 the 37th CEAS Board of Trustees (BoT) Meeting took place at the Royal Aeronautical Society's headquarters at Hamilton Place 4, London.
Important points on the Agenda were:
- Election and confirmation of the CEAS Officers for 2017;
- Preparation of the CEAS/Aerospace Europe Conference 2017;
- CEAS Awards;
- Status of the ECAero2 project;
- Follow-up of relations with institutions having signed with the CEAS a Memorandum of Understanding;
- CEAS Aeronautical and Space Journal Statistics.

President and Officers for 2017

At the 37th CEAS BoT meeting the new officers for the year 2017 had to be elected. After having being CEAS President for 3 years I had decided it was time for a new CEAS President. The CEAS Member Society NVvL had proposed Christophe Hermans as new CEAS President. Christophe is Deputy Director of the German-Dutch Windtunnels DNW and Chief Technology Advisor of NLR. Since 2006 he is General Secretary of the Netherlands Association of Aeronautical Engineers NVvL. Since 2007 he is member of the CEAS BoT and from 2010 the Chairman of the CEAS Aeronautics Branch. He has been the chairman of Programme Committees of the European Rotorcraft Forum in 2006 and 2012 and Chairman of the CEAS 2015 Programme Committee in Delft.
This NVvL proposal had been accepted by the CEAS Board of Trustees and **Christophe Hermans** was unanimously elected as the new CEAS President as of January 1, 2017.
In the interim Christophe will remain Chairman of the CEAS Aeronautics Branch.
Torben K. Henriksen will be the successor of Constantinos Stavrinidis as the new chairman of the CEAS Space Branch.
The other CEAS Officers will remain unchanged in 2017: Cornelia Hillenherms as VP Finance, Pierre Bescond as VP Publications and External Relations and Kaj Lundahl as VP Awards and Membership.

CEAS/Aerospace Europe Conference in 2017

The promotion of the CEAS/Aerospace Europe 2017 Conference is in full swing. In September 25-30 2017, at the 30th Congress of the International Council of the Aeronautical Sciences, extensive promotion was made for the CEAS 2017 Congress, in the form of flyers and the speech of the new ICAS President Susan Ying.
In October 11-13 at the Greener Aviation Conference in Brussels, Christophe Hermans gave a keynote in which the CEAS 2017 Conference was promoted.
During the symposium at the occasion of 75 years of NVvL a keynote was given by Christophe Hermans on the international relations of NVvL, in which CEAS plays an essential role. The CEAS 2017 conference was promoted.
Additional support of the CEAS Member Societies and MoU partners is still essential to make the CEAS 2017 Conference a success.

CEAS Awards

The CEAS Gold Award 2016 was presented on the evening of November 28 at the RAeS Award Ceremony to Dr Gordon McConnell.
This was also a unique opportunity to provide visibility for this prestigious CEAS award. The CEAS Gold Award 2017

will be presented to Eric Dautriat at the CEAS Congress 2017. The request for nominees for the CEAS Gold Award 2018 has been published to the CEAS Member Societies. This is also done for the CEAS Technical Award 2017.

Status of the ECAero 2 project and a joint Aerospace Europe Conference

In order to strengthen the European position with respect to aerospace congresses it is essential to coordinate the national congresses, organized by the CEAS Member Societies and the European Congresses, organised by CEAS, EASN and EUCASS.
In the CEAS Bulletin since a long time the information of the CEAS Conference Programming Management Information System (CPMIS) is published to inform the CEAS Member Societies, its Corporate Members and MoU partners about all the aerospace conferences planned.
The ECAero2 project focuses on the development of tools for the dissemination of information on planned internatio-

nal congresses, for the organizing of European congresses and for the dissemination of papers presented on the congresses. Furthermore activities have been started towards a joint European Aerospace Conference in 2017. This has not yet been possible, so now the focus is on a joint Aerospace Europe Congress in 2019. And to try to combine this European Aerospace Congress with the EC Aeronautics Days ('Aerodays'), CEAS is strongly supporting this coordination and joining of European Aerospace Conferences.
CEAS participated in the ECAero2 meetings in Brussels on October 14 and in Amsterdam on December 1 and 2. In ECAero2 CEAS cooperates with EUCASS, EUROMECH, EUROTURBO, ERCOFTAC and ECCOMAS.
A strong support has been provided by Dietrich Knoerzer as well as by the Clean Sky Joint Undertaking.

CEAS Memoranda of Understanding

As decided during the CEAS BOT meeting on September 7 in Warsaw, CEAS will honour its MoU obligations by informing on a regular basis its MoU partners by informing them on the CEAS activities and looking for opportunities for cooperation.

- In September at the ICAS Congress in Daejeon, South Korea, a MoU follow-up contact was made with the Korean Society for Aeronautical and Space Science (KSAS) and the American Institute for Aeronautics and Astronautics AIAA.
- In September at the IAF in Guadalajara, Mexico, contact was made with the Chinese Society of Astronautics CSA.
- On November 3 in Paris a MoU follow-up meeting was held with the Académie de l'Air et de l'Espace (Air and Space Academy – AAE).
- On December 7 in Brussels a MoU follow-up meeting will be with the European Research Establishments in Aeronautics EREA.

A new CEAS MoU proposal was made to International Forum for Aerospace Research, IFAR.
Furthermore at the ICAS Congress discussions were held with the Chinese Society of Aeronautics and Astronautics CSAA and with the Brazilian Aerospace Society ABCM.

CEAS Aeronautical and Space Journals

The CEAS Aeronautical and Space Journals are becoming ever stronger.

- For the CEAS Space Journal between January 2013 and November 2016, 173 papers were submitted. The average acceptance rate was about 75%. In total 137 peers reviewed papers were published. About 50% of the CEAS Space Journal papers come from Germany, but the number of papers coming from other CEAS Member Societies and other international organisations is growing.
- For the CEAS Aeronautical Journal between January 2013 and November2016, 355 papers were submitted. The average rejection rate was also around 75%. In total 201 peers reviewed papers were published. Most of the papers are from Germany, but gradually the number of papers from the other CEAS Member Societies and from non-European organisations are growing.

The publisher Springer is assessing the impact factor/attractiveness of the CEAS Journals in relation to other international journals.

CV CHRISTOPHE HERMANS

German Dutch Wind tunnels DNW

Christophe Hermans was appointed Deputy Director of the German Dutch Wind tunnels DNW in April 2012. DNW operates 11 wind tunnels at 5 sites in both the Netherlands and Germany, the most well-known being the Large Low speed Facility LLF in the Noordoostpolder.

Netherlands Aerospace Center NLR

He started his professional career at NLR in the mid-eighties as a helicopter flight mechanics specialist being involved in the development of NLR's rotorcraft fixed-base simulator. In the early nineties, as project manager, he was responsible for the wind tunnel test activities supporting the design of the multi-nation NH90 transport helicopter.
In 2004 Christophe became responsible for NLR's helicopter and aeroacoustics department. For 2 years he was member of the Garteur, the organization for aeronautics research collaboration in Europe, Executive Committee & Council. Since April 2016 he is responsible for the knowledge and innovation development at NLR as Chief Technology Advisor CTA.
Netherlands Association of Aeronautical Engineers (NVvL), CEAS and ERF
In 2006 he joined the board of the 'Nederlandse Vereniging voor Luchtvaarttechniek (NVvL) as secretary general and the Board of Trustees of the Council of European Aerospace Societies (CEAS), where he is acting as branch chief aeronautics since 2010.
As national representative of the International Committee of the European Rotorcraft Forum (ERF) he chaired the CEAS rotorcraft technical committee for a period of 4 years.
As chairman of the Programme Committee for the CEAS 2015 Air and Space Conference he was responsible for the content of the conference

Education

Before joining NLR, Christophe received his aeronautical master degree (Diplom Ingenieur) from the Technical University of Aachen (Germany).

NVvL's 75TH ANNIVERSARY CELEBRATION

AERONAUTICS: 50 YEARS FROM NOW

The NVvL's 75th anniversary celebration was held on 22 november 2016 at the National Military Museum, Park Vliegbasis, Soesterberg, the Netherlands

Welcome to the NVvL's 75th anniversary celebration!
It is a great pleasure to welcome you this symposium and networking dinner that marks the association's 75th anniversary.
Members and guests are invited to celebrate this milestone in the history of the Netherlands Association of Aeronautical Engineers in the impressive venue of the National Military Museum.
I'm delighted to offer you a program with distinguished keynote speakers and presentations that will provide their view on the future of aeronautics. Of course we will also pay tribute to the remarkable achievements of the association in the past 75 years, the history that has been captured in a limited edition book.
We are also proud to have this year's best young aeronautical engineers, nominated by the universities, universities of applied sciences and defence academy. The best bachelor and master thesis will receive the newly established Wittenberg awards.
Welcome to Soesterberg and I am certain you will enjoy the celebrations at a remarkable venue with its historic objects!

Fred Abbink
NVvL President

Organising Committee & NVvL daily board
- Fred Abbink (Chairman), NVvL
- Christophe Hermans, German-Dutch Wind Tunnels DNW
- Piet Kluit, NVvL

NVvL history

Prof.dr.ir. W.Th. Koiter

Ir. C. Koning

The Netherlands Association of Aeronautical Engineers NVvL is the not for profit organization in the Netherlands which provides a platform for all with a professional or a private interest in aerospace technology. The NVvL promotes research, science and technology in aerospace engineering. With its approx. 350 members, the NVvL is the only association in The Netherlands which is represented in all specialist and work areas of the aerospace sector - from the industry to government, education and research.

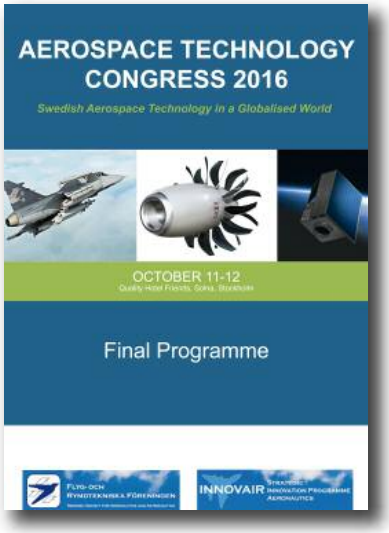
Although already in February 1940, ir. W.Th. Koiter undertook the initiative to start a society of professional aerospace engineers and scientists. Due to the outbreak of World War II, the constituent meeting took place more than one year later, on the 26th of April 1941 at the premises of the National Aeronautics Laboratory, NLL, in Amsterdam. At the start the NVvL, then called "Club voor Wetenschappelijke Luchtvaarttechniek", was founded as a new branch ("Vakafdeling Luchtvaarttechniek") of the Royal Netherlands Aeronautical Association (KNVvL). Nevertheless, from the start in 1941 it was a legal entity in itself.

The first chairman was ir. C. Koning, Scientific Director of NLL (now NLR) and also Fokker, KLM and the University of Delft were represented in the first board. Around 1950, the name of the organization was officially changed to "Nederlandse Vereniging voor Luchtvaarttechniek" (NVvL) and until today the board of the association is mainly composed of representatives of all important professional organizations in aeronautics in the Netherlands.

MEMOS FROM THE CONGRESS - SWEDISH AEROSPACE TECHNOLOGY IN A GLOBALISED WORLD, 11-12 OCTOBER, 2016

By Captain Roland Karlsson, FTF's President

This year's triennial National Congress in Aeronautics and Space Technology, arranged by the Society of Aeronautics and Astronautics (FTF), was held in Stockholm/Solna on October 11-12, in co-operation with the Strategic Innovation Programme Aeronautics (Innovair). It was the ninth Congress in succession and evolved into a semi-national event thanks to the extensive bilateral collaboration between Sweden and Brazil. The newly opened Quality Hotel Friends was chosen as the venue, which is co-located with Friends Arena, and it´s 62 000 seats. The location also includes a hotel with 400 rooms and a large shopping mall.



A homepage dedicated to the Congress was established about 15 months ahead of the Congress, and Call for Papers was published on the web about nine months before the Congress. The deadline was set for six months before the start date, but as progress seemed slow the deadline was extended about a month. The Call for Papers was also distributed electronically to some 2000 recipients, but no paper version was made.

The total number of delegates was 307, and about half of those were registered in the last month before the Congress. Individual links for registration were provided on the homepage for the different categories of delegates. An increased number of delegates from academia was noted, even from institutions outside of the metropolitan areas in Sweden. However, delegates from Swedish authorities was sparse, and likewise from some of the larger aerospace industries. For guidance and assistance to delegates in the meeting rooms, student volunteers were recruited from the Space Programme at The Royal Institute of Technology (KTH), which turned out very well. Mingle areas were adjacent to the meeting rooms and included in the exhibition area. A dinner was held at the venue on the first evening, and a 20-women choir performed entertainment. A few talks were held, but discussions and mingle around the 35 round tables were apparently found more important.

About 180 abstracts were received for the Congress, of which about 80 came from Brazil. Only a few abstracts were refused, and 13 sessions were set in the preliminary programme that was published four months before the Congress. A few speakers asked for a template for LaTeX document production, and such is available for publication in the CEAS Journal. 26 "Full papers" were received with the intent to be published in the CEAS Journal. Only a few posters were shown at the Congress.

The final programme was published in a paper booklet that was distributed at the registration desk. Moreover, a link to a dedicated Application (Apple and Android) was sent by SMS to registered delegates a few days before the opening. The application was held updated in real time and included a list of participants, an overview of meeting rooms, and a brief biography of the plenary speakers.

The Brazilian Ambassador to Sweden formally opened the Congress, followed by 7 invited plenary speakers on the morning of the first day and nine on the afternoon on day two. The speeches were of a very high quality, but we found that the number of speeches on the second day was a little too high and perhaps top-heavy. The plenary speeches and most of the presentations are published (by consent from the lead authors) on the FTF website.

Enrolling of exhibitors (partners) was initially slow, but evolved into a fully booked session with nine attending companies in three different partner packages. A press release about the Congress was sent out, however late, but no or very little response from media was noted, which is a known problem for aerospace in Sweden.

In summary, the FTF finds the Congress on Swedish Aerospace Technology 2016 as very successful, which also is reflected in the feedback. Moreover, our economic goals were fulfilled and are a base for the continued work of our comparatively small society of FTF.

The success of the meeting has led the organisers to once again try to get the ICAS Congress back to Sweden. Our aim is to submit a bid to ICAS for arranging ICAS 2022 in Stockholm, following this year's ICAS event in South Korea, the 2018 meeting in Brazil, and the 2020 meeting in China. Clearly, ICAS 2022 needs to get back to Europe and Sweden, with one of the largest industrial capabilities and a proven track record from earlier ICAS organisation, recent CEAS conference in Linköping, and this year's successful event makes a logical choice for hosting ICAS 2022.

THE EUROPEAN ROTORCRAFT FORUM 2016 WAS HELD IN LILLE ON 6-8 SEPTEMBER

Blanche Demaret, ONERA, President of 3AF Helicopters Technical Committee

From left to right: Marius Bebesel, Airbus Helicopters Deutschland - Jean-Brice Dumont, VP AH SAS - Dr Klausdieter Pahlke, Chair of the Aerodynamic Session, CEAS Rotorcraft Technical Committee.

The 2016 edition was a success in terms of content, complete and rich, and interests of major players in the sector, as industrial institutions.
The edition 2016 is a good vintage: 213 participants, 103 papers presented and 19 countries represented. A plenary session per day was settled to have stakeholders providing complementary vision to the technical sessions.

During his keynote address, Jean-Brice Dumont Vice President Research and Innovation Helicopters Airbus spoke about the helicopter market and about the growing efforts towards more autonomous flights (OPV) or fully autonomous and the wide market for VTOL drones. The operational maintenance of aircraft in service in the French Army has been addressed by a specialist AIA-CP (French Ministry of Defence- Air Force). The Director of Operations of the DGA (French MoD), the IGA (Lieutenant-General) Monique Legrand-Larroche has reminded that helicopters are essential in the foreign operations. She also addressed the evolution of specifications as well as the required changes due to the lessons learned from operations and the future for military rotorcraft. The main topics being affordability, availability and taking into account the maintenance from the beginning.

During the Opening Ceremony, Dr Klausdieter Pahlke (DLR, German National Research Center) as the Chair of the CEAS Rotorcraft Group and Jean-Brice Dumont handled the CEAS AWARD 2016 to the BlueCopter Team of Airbus Helicopters Deutschland, represented by Dr Marius Bebesel. The demonstrator of the BlueCopter demonstrates numerous breakthrough solutions for decreasing noise in approach and flight eco friendly. Time was given to Marius Bebesel to summarize the main results of the demonstration especially with a very impressive low noise approach.

THE EUROPEAN ROTORCRAFT FORUM INTERNATIONAL COMMITTEE IS GLAD TO ANNOUNCE THE LAUREATES OF THE 42ND EUROPEAN ROTORCRAFT FORUM FOLLOWING AWARDS:

CHEESEMAN AWARD:

- **Sascha SCHNEIDER**, AIRBUS HELICOPTERS Deutschland GmbH, DE
- Co-author **Rainer HEGER**, AIRBUS HELICOPTERS Deutschland GmbH, DE

"BLUECOPTER™ demonstrator: The state-of-the art in low noise design"

PADFIELD AWARD:

- **Morgane MARINO**, AIRBUS HELICOPTERS, FR

"Numerical Analysis of the Internal and External Flows of the Fenestron® under Complex Flight Conditions" (title of the presentation is "A Large Eddy Simulation of the Fenestron® at high blade pitch angle").

► Proceedings are available at **http://erf2016.com/ERF2016_proceedings/** or via 3AF (erf2016@aaaf.asso.fr)

We extend our warmest congratulations to both of them and thank all the ERF2016 authors.

The Cheeseman Award for the ERF best paper prepared for and presented at the European Rotorcraft Forum has been established to recognize the author(s) who has/have prepared and presented the most significant technical paper as judged and selected by his/her peers. The selected paper is presented at the next Forum of the American Helicopter Society AHS.

The Padfield Award for the ERF best paper prepared for and presented at the European Rotorcraft Forum ERF has been established to recognize the author(s) not older than 30 years of age who has/have prepared and presented the most significant technical paper as judged and selected by his/her peers.

While the quality of the archived paper is paramount in the selection process, the quality of the presentation of the material at the Forum must also be taken into account.

ERF

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ROTORCRAFT VIRTUAL ENGINEERING

Supporting Life-Cycle Engineering Through Design and Development, Test and Certification and Operations

The disparate topics shown on page 12 all featured in the **Rotorcraft Virtual Engineering (RVE)** Conference held in The University of Liverpool's Foresight Centre, and they contained a common language - modelling and simulation in support of a rotorcraft's life-cycle. Virtual Engineering (VE) was defined as the creation and use of Virtual Prototypes to support decision-making throughout the life-cycle, which may be 50+ years for a rotorcraft.
The Conference comprised 24 papers, including 6 key-notes, spread over 6 serial sessions in 2.5 days, with a technical tour of the University's simulation facilities and 3 panel discussions.

Mike Hirschberg, Executive Director of the American Helicopter Society International, opened the Conference on behalf of the partner Societies, handing over to the Conference Chair, Professor Gareth Padfield, to give the Introductory talk. Padfield suggested that the rotorcraft industry needs VE first to ensure decisions made early in the life cycle, at the requirements capture and preliminary design phases, are reliably informed. Then later, in design, development and qualification, Virtual Prototypes can become centres of attention for critical reviews and, ultimately, certification itself. A significant challenge is to ensure that model fidelity is good enough, not only for supporting design decisions but also in establishing requirements based on sufficiently mature technologies.

Fig. 1 illustrates the general form of the cumulative % of life-cycle costs, both expended and committed. 75% of a product's cost can be committed through the decisions made and actions taken in the first 10% of the life-cycle. If we consider the cost to fix problems in this first 10% as one unit, then the cost to fix grows by several orders of magnitude as the project advances. There are enough examples of such 'failures' across the aerospace industry that the case for investment in VE tools and capabilities is compelling.

The Conference delegation quickly became a community, drawing out more and more detail and read-across from one area to another. The keynote presentations by Airbus Helicopters and Leonardo Helicopters were particularly important contributions to the Conference as they provided a glimpse of the status and practice of VE application in the rotorcraft manufacturing industries. There is a constant trade-off between the use of fast and simple (lower fidelity) and slow and complex (higher fidelity) modelling in design and development, particularly for flight test support when schedules are challenging. Coupled CFD (computational fluid dynamics) and Flight Mechanics (FM) codes are commonly used to examine interactional aerodynamic issues. The Airbus Helicopters' Perspective on VE support in the life cycle is summarised in Fig 2.

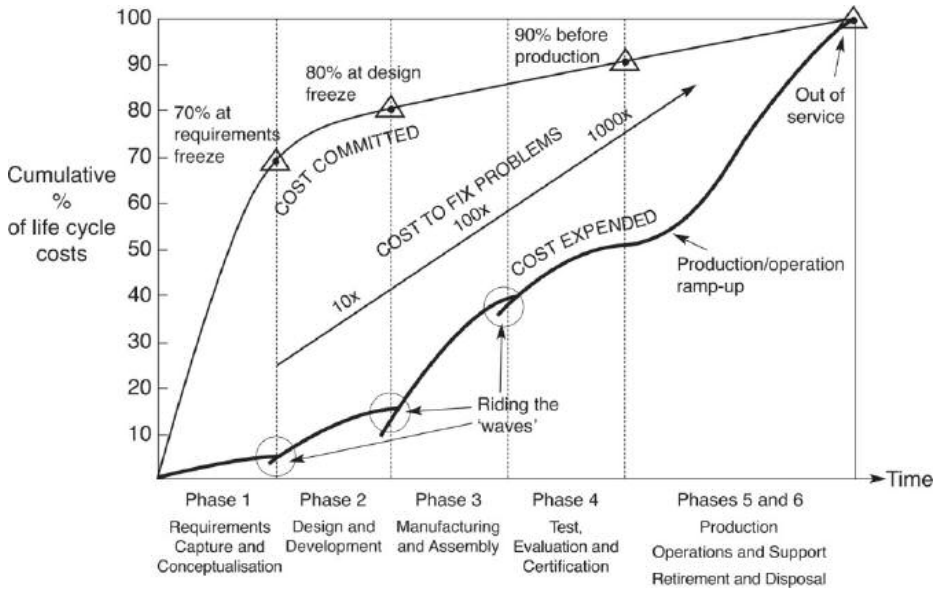

Fig. 1 Committed and Expended Costs during the life Cycle of a Product (Padfield, So You Want To Be An Engineer, ISBN 978-069929017, based on INCOSE's Systems Engineering Handbook)

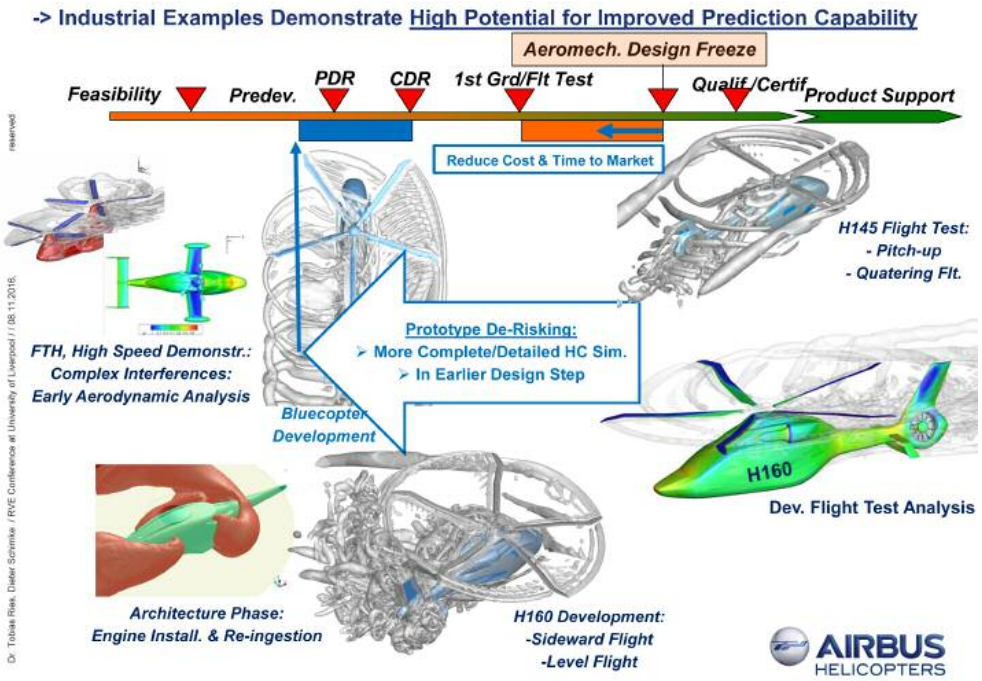

Fig. 2: An Airbus Helicopters' Perspective on VE support in the life cycle. (Ries and Schminke, Industrial Prediction of Helicopters in Flight)

1. Certification of a helicopter engine-off landing capability
2. Evolution of an innovative rotor system from concept to production
3. Design of a warship to be helicopter-friendly
4. Design of a helicopter empennage to minimise pitch-up
5. Optimise rotorcraft performance and handling qualities during the concept phase
6. Understand how ground particles drawn up by the rotor downwash damage the fuselage
7. Predict the failure characteristics on non-conventional laminates
8. Optimise motion drive laws for training flight simulators
9. Quantify uncertainty during the analysis of alternatives early in the acquisition cycle
10. Train engineers in advanced modelling and simulation skills using problem-based-learning techniques

In the Leonardo keynote, Bianco-Mengotti introduced the triangle of advantages – safety, effectiveness and economy – that VE offers helicopter manufacturers. A success story for the safety advantage was described relating to tail rotor failure, considered in the design of the AW169 helicopter, to ensure recovery was possible and to provide guidance on the recovery technique for pilots. A second example was cited in the companion paper (Bianco-Mengotti, Ragazzi) addressing the 'AW189 Engine-off Landing Certification by Simulation'. Piloted simulation results were used to enable the design to meet the relevant CS-29 certification requirements. Validation against flight data was critically important in both these examples (Fig. 3).

Turning to the cost advantage, Bianco-Mengotti stated that the use of engineering simulators can reduce costs to below 10% of those incurred in flight test. The third advantage, effectiveness, was described in terms of the flexibility

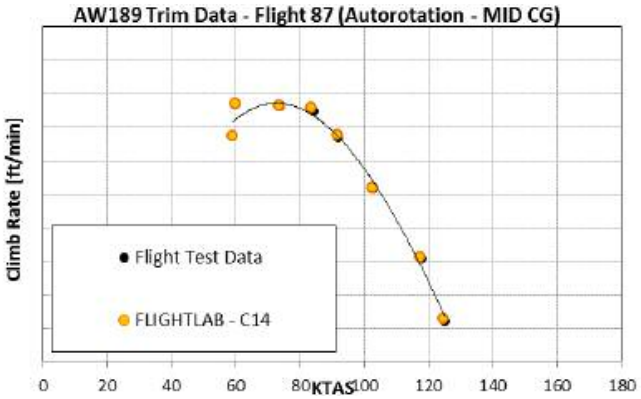

Fig. 3 The AW189 with correlation of flight test and simulation for rate of climb in the mid-speed range showing good model

offered by simulation, compared with real flight, in terms of exploration of the design space and 'what-if' scenarios. The simulation can also 'measure' parameters not always available in flight, offering specialists a greater understanding of the relationships between causes and effects.

Session 1 contained four papers from research centres on VE in conceptual design, with a recurring theme being the required model fidelity. Sinsay (US Army) re-imagined design in terms of reducing uncertainties in outcomes, categorising fidelity in different levels for different disciplines and emphasising the need for an integrated design environment that enhances creativity, and presenting a

comprehensive picture of the VE tools deployed in conceptual design (Fig. 4) categorized in three fidelity levels.

In his paper on conceptual design, Van der Velden's described an approach where user requirements and system attributes are quantified as probability density functions, with a desired value and uncertainty. He argued that "*there is a serious question of whether an analysis of alternatives fairly compares different concepts when different technologies simulated by different analysis models are used*", because of the low VE fidelity used at the conceptual design stage. Also, activities that occur later in the lifecycle, such as system development, airworthiness qualification and safety assessment, are often left out here, but could be brought in as part of the virtual prototyping.

The application of VE in requirements capture and conceptual design enables acquisition agencies and their research centres to develop better understandings of, for example, the mission effectiveness benefits and risks associated with stretched requirements and new technologies. In his keynote paper 'A Model-Based Engineering Approach for Value-Based Acquisition (VBA)', Schrage emphasized that VBA was about "*capturing essential Life-Cycle Engineering elements as a ratio of System Effectiveness to Life Cycle Cost.*" From the established need, would then follow two major activities:

1. *"Use integrated Model Based Engineering (MBE) and Model Based Systems Engineering (MBSE) to develop baseline deterministic virtual prototypes for conducting trade-offs using Cost Capability Analysis (CCA) for decision-making at progressive milestones of the acquisition process,*
2. *Transform a Deterministic Virtual Prototyping to a Stochastic Virtual Prototyping process to measure the level of modelling uncertainty and risk that exists and what confidence is required at the next major milestone."*

Schrage's presentation focused on how RVE might aid the acquisition and design processes for the US Army's Future Vertical Lift (FVL) program, and described how VE can support and strengthen the participation of all stakeholders in the system acquisition process.

Session 2 mainly addressed how CFD featured as a VE tool. In the keynote presentation, Beaumier and co-author Schwarz described the DLR-ONERA vision for the future of CFD tools. Beaumier stated that "*current state-of-the-art software solves the Reynolds-Averaged Navier-Stokes (RANS) equations with the adjunction of more or less sophisticated turbulence models and are capable of simulating the aerodynamics of complete helicopters with good accuracy.*" This capability has resulted from close collaboration between the two laboratories, gradually refining tools (e.g. Fig. 5). The authors presented their roadmaps for CFD development targeting massive parallel HPC platforms, higher order accuracy, increased reliability, improved physical modelling and open architecture software for coupling with other disciplines; adding that "*one of the challenges is to incorporate the engineering knowledge of a human into numerical algorithms in terms of goal functions and constraints.*"

Owen presented highlights from a decade of research at Liverpool using CFD and piloted simulation to create a virtual helicopter-ship dynamic interface to explore such aspects as flight control design, pilot workload in the turbulent ship's airwake and the design of ships to enhance their helicopter-friendliness. Fig. 6 illustrates features on the superstructure that give rise to particular problems for the pilot in starboard winds. In this case, the FLIGHTLAB helicopter model was flown along the approach and lan-

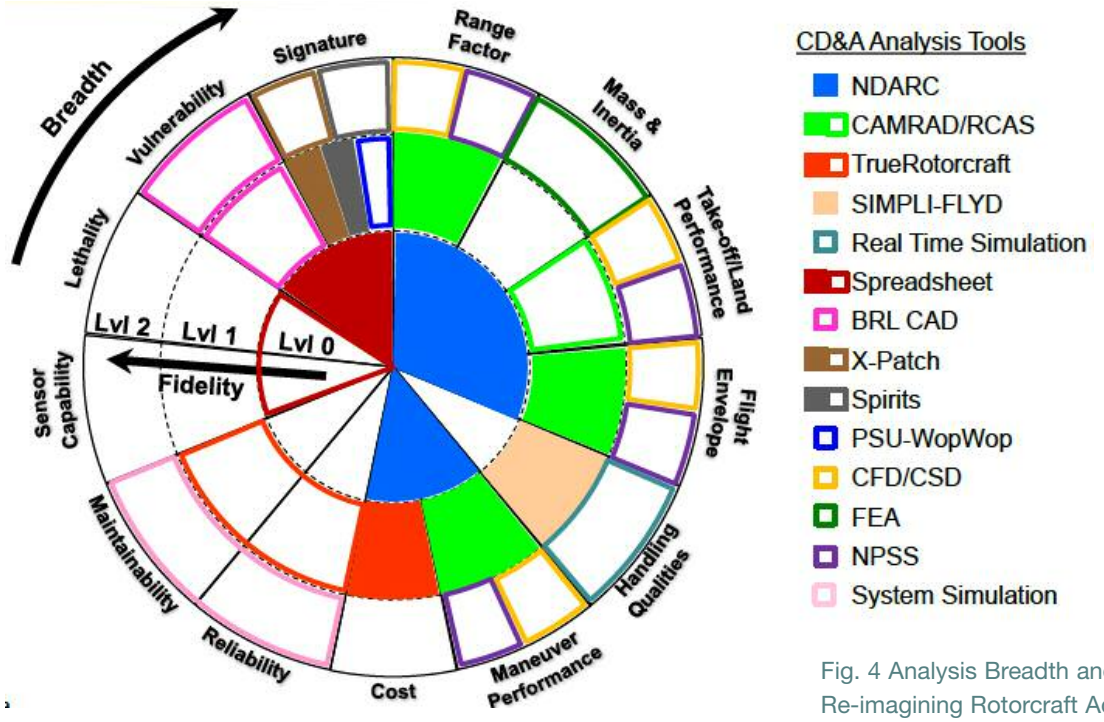

Fig. 4 Analysis Breadth and Fidelity (Sinsay, Re-imagining Rotorcraft Advanced Design)

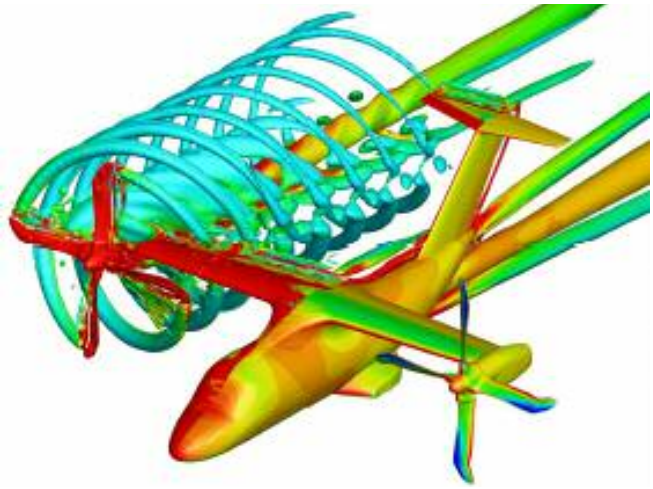

Fig. 5 elsA calculation of a tilt-rotor full configuration (Beaumier and Schwarz)

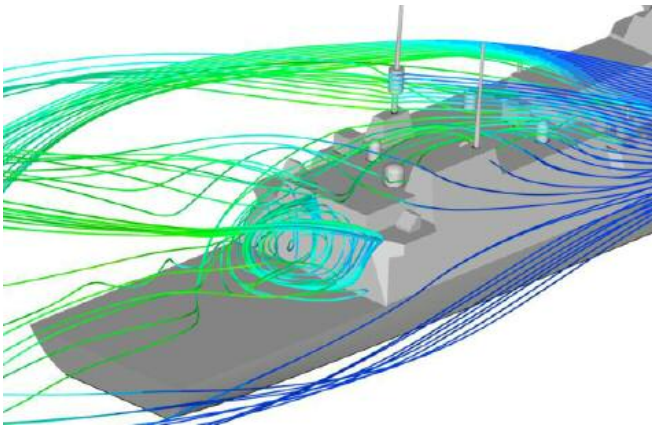

Fig. 6 Assessment of Future Frigate Superstructure Aerodynamics (Owen)

ding flight path to establish the areas where loadings, both steady and unsteady, would become difficult for a pilot to overcome.

Several papers addressed VE in design and certification. Beaumier described a 24-year long joint ONERA/DLR/Airbus programme, supported by numerical tools of varying complexity, to develop a new rotor system, achieving optimisation of aeroacoustic signature, structural dynamics and flight performance.

The first phase of the Blue EdgeTM project examined variations of the rotorblade design using CFD. It became apparent that aeroelastic tailoring would be essential for rotor stability and structural integrity. Phase 4 included a flight demonstration of the new rotor on a EC155 demonstrator. The success of the research and technology demonstration underpinned the maturity of the concept and a commitment was made to the first prototype of the Airbus H160 helicopter (Fig. 7).

Van Tooren gave his keynote on the theme of VE applied to "*improving the performance of the fully composite aircraft*', including the certification of non-conventional composite structures (e.g. when fiber layup angles change, or are steered, within a ply). Gaining insight into mechanisms that control the various interfaces in a composite structure

Fig. 7 Flight testing trials of an Airbus Helicopters H160 prototype (Beaumier)

requires modelling the molecular dynamics to predict the positions of atoms versus time, derived from the forces exerted on an atom by the neighbouring atoms.

The technique of curving fibre paths allows the tuning of load paths and strength from point to point in the structure, offering more design freedom than with isotropic-material-based design concepts. However, the increased design freedom comes with an increase in complexity of the material characterisation in a design environment. The current CAD/CAE generation is not yet able to support this amount of freedom. Fibre steering can be used to "create constant failure index structures with simultaneous stiffness and strength design to match load distribution and material system strength." (e.g. Fig. 8).

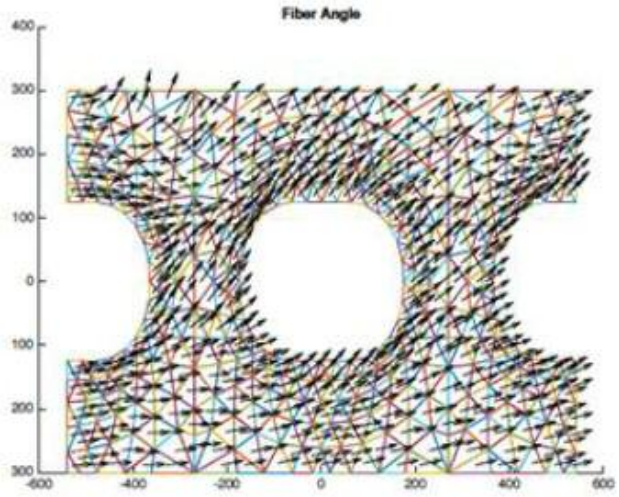

Fig. 8 Example of a fibre angle field resulting from the optimisation within TopSteer (Van Tooren)

Van Tooren states that the adoption of new multi-scale VE is strongly reinforcing. "Coupling of VE-based modelling applied to different length scales will help to understand the effects of changes on a microscopic scale on technology on a macroscale. VE-supported application of the presented technologies on a macroscopic scale will help manufacturing engineers to apply the novelties in a controlled manner."

Two VE product-oriented papers featured in the Conference, giving delegates an opportunity to see

advances in commercially available VE tools. DuVal's presentation (FLIGHTLAB; A Suite of Rotorcraft VE Tools) appeared in Session 3 and Van der Veldon's (Multi-Scale, Multi-Physics Systems Engineering) in Session 6. DuVal also gave a more extensive description of Advanced Rotorcraft Technology's FLIGHTLAB tools during the technical tour and the range of Dassault Systemes/SIMULIA VE tools, supporting the whole life-cycle, was also on display in the Conference networking space.

The Conference chair, Gareth Padfield, ended his Introductory talk with his vision for VE in the rotorcraft life cycle, shown below. The bullet points are self-explanatory but the final piece of rhetoric suggested that VE offers the opportunity to restore grace, imagination and artistry to the design process, through opportunities for discovery and insight, spurs to innovation, and rapid-prototyping of ideas for 'true' optimisation.

The lead sponsor for the Conference was Leonardo Helicopters and Riccardo Bianco-Mengotti entertained the delegation in his pre-dinner talk about Leonardo da Vinci's use of virtual engineering over 500 years ago.

Finally, the preparatory work of the lead engineers representing the various organisations, and subsequently as Session Chairs and Panel Discussion Moderators, was critical to the success of the Conference and these people deserve a special thanks.

A VISION FOR VIRTUAL ENGINEERING IN THE ROTORCRAFT LIFE CYCLES

- **Let the Virtual Prototype become the centre of attention for synthesis, analysis and decision making throughout rotorcraft life-cycle phases**
- **Use common VPs and data throughout rotorcraft life-cycle phases**
- **Undertake VP Verification and Validation in regulatory-style throughout the life-cycle**
- **Create a VE approach to failure analysis, from the fractured pipe and the broken wire to the confused pilot**
- **Industry and Academia, working in partnership, focus on developing engineers with advanced VE skills and competencies for dealing with very complex systems**
- **Restore grace, imagination and artistry to the design process**

The Conference papers and presentations will become available through a portal on the Royal Aeronautical Society's website, **http://www.aerosociety.com/About-Us/Shop/Shop-Products?category=Proceedings.**

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LAUNCH OF NEW GALILEO NAVIGATION QUARTET - FLYING THE FANTASTIC FOUR

FLYING THE FANTASTIC FOUR

17 November 2016

On 17 November 2016 at 13:06 GMT an Ariane 5 has launched 4 additional Galileo satellites – numbers 15 to 18 – from Guyana Space Centre. The first pair was released 3 hours 35 min 44 sec after liftoff, while the second separated 20 minutes later.

The four satellites arrived at their target altitude (23 200 km) after a flawless release from the new dispenser designed to handle four satellites.

This is the first time that four Galileo satellites were launched with one rocket, so accelerating deployment of the constellation (the previous 14 satellites were launched 2 at a time using the Soyuz-Frigat rocket).

► **Two additional Ariane 5/new dispenser launches are scheduled in 2017 and 2018.**

► **The full system of 24 satellites plus spares is expected to be in place by 2020.**

► **The 18 satellites already in orbit allow the European Commission to declare the start of initial services very soon.**

Liftoff of Ariane flight VA233, carrying four Galileo satellites, from Europe's Spaceport in Kourou, French Guiana, on 17 November 2016. © ESA–Stephane Corvaja, 2016

Quad satellite see space. Already above Earth's atmosphere, Ariane's aerodynamic fairing is jettisoned and the four Galileo satellites 'see' space for the first time.
© ESA–P. Carril

Cutaway view shows the four Galileo satellites mounted on top of a specially adapted Ariane 5 rocket underneath the aerodynamic fairing. ©ESA–P. Carril

ESA ASTRONAUT THOMAS PESQUET ARRIVED AT THE INTERNATIONAL SPACE STATION ON 20 NOVEMBER AT 00:40 GMT

ESA astronaut **Thomas Pesquet**, NASA astronaut Peggy Whitson and Roscosmos commander Oleg Novitsky docked with the International Space Station today after a two-day flight in their Soyuz MS-03 spacecraft.

The trio was launched from the Baikonur cosmodrome in Kazakhstan 17 November at 20:20 GMT and enjoyed a routine flight to catch up with the Space Station 400 km up. This was the first launch of an ESA astronaut on an upgraded version of the workhorse spacecraft that has been in service for almost 50 years. Despite the modernisation, for the crew it was like spending **two days** in a small car. Throughout the journey the astronauts kept in radio contact with Moscow ground control.

After docking on 19 november at 21:58 GMT, Thomas, Peggy and Oleg were welcomed aboard the Space Station at 00:40 GMT by NASA astronaut Shane Kimbrough and cosmonauts Andrei Borisenko and Sergei Ryzhikov.

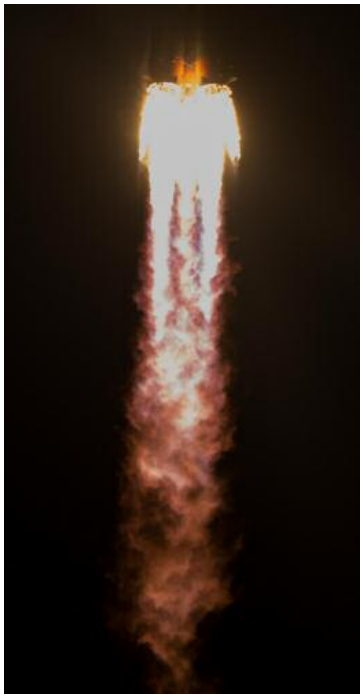
The six will maintain the Station and work on scientific experiments that cannot be done anywhere else, exploiting the weightlessness that is unique to the space laboratory.

This marks the start of Thomas's Proxima mission, named after the closest star to the Sun – continuing a tradition of naming missions with French astronauts after stars and constellations.

The mission is part of ESA's vision to use Earth-orbiting spacecraft as a place to live and work for the benefit of European society while using the experience to prepare for future voyages of exploration further into the Solar System. Thomas will perform about 50 scientific experiments for ESA and France's CNES space agency, as well as take part in many research activities for the other Station partners.

This is the ninth long-duration mission for an ESA astronaut and Thomas is the last of ESA's 2009 recruits to fly into space. A former airline pilot, he is the first French astronaut to visit the Station since ESA's Léopold Eyharts helped to install Europe's Columbus module in 2008.

The new arrivals will spend six months in space before returning in Soyuz MS-03 to land in the steppes of Kazakhstan. ESA's Paolo Nespoli, backup on this mission, is readying himself for launch in 2017 shortly after Thomas returns.



Proxima liftoff: ESA astronaut Thomas Pesquet, NASA astronaut Peggy Whitson and Roscosmos commander Oleg Novitsky were launched to the International Space Station on 17 November from Baikonur cosmodrome in Kazakhstan on their Soyuz MS-03 spacecraft. © ESA–Manuel Pedoussaut, 2016

ESA astronaut Thomas Pesquet waves farewell to family and friends as he departs the Cosmonaut Hotel to suit-up for the Soyuz launch to the International Space Station, in Baikonur, Kazakhstan, on 17 November 2016.
© ESA–Manuel Pedoussaut, 2016

EUROPEAN MINISTERS READY ESA FOR A EUROPE UNITED IN THE ERA OF SPACE 4.0

2 December 2016

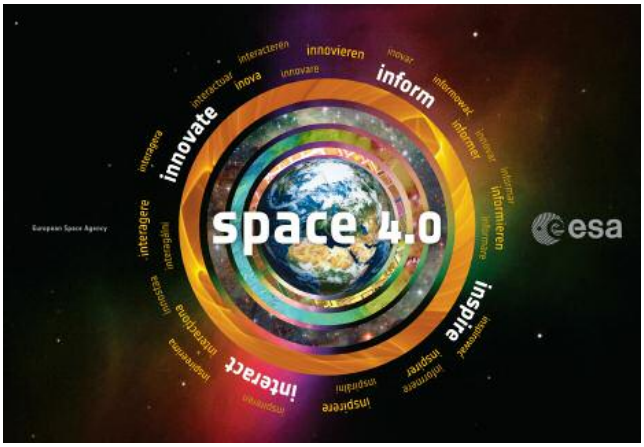
ESA today concluded a two-day Council meeting at ministerial level in Lucerne, Switzerland. Ministers in charge for space matters from ESA's 22 member states plus Slovenia and Canada allocated €10.3 billion for space activities and programmes based on the vision of a United Space in Europe in the era of Space 4.0.

The high level of subscriptions demonstrates once more that ESA's Member States consider space as a strategic and attractive investment with a particularly high socio-economic value.

It also underlines that ESA is THE European Space Agency capable of channeling their investment to respond effectively to regional, national and European needs by covering all elements of space: science, human spaceflight, exploration, launchers, telecommunications, navigation, Earth observation, applications (combining space, airborne and terrestrial technology), operations and technologies; as well as responding to the needs and challenges of Europe and the Member States by bringing together all stakeholders.

Ministers confirmed the confidence that ESA can conceptualize, shape and organize the change in the European space sector and in ESA itself. While also acting as a global player, broker and mediator at the centre of international cooperation in space activities, in areas ranging from the far away in exploration (with the concept of a Moon Village for instance) to supporting closer to home the international global climate research effort following the Paris Agreement of 2015.

At this summit, Ministers in charge of space matters have declared support for ESA's Director General's vision for Europe in space and the role and development of ESA: now the Space 4.0i era can start with ESA committing to **inform, innovate, interact** and **inspire**. And, building on commercialization, participation, digitalization, jobs and growth, the concept of "**United Space in Europe**" will soon become a reality.



Innovate, inform, interact and inspire: Space 4.0
ESA's Ministerial Council in Lucerne, Switzerland, 1 and 2 December 2016. © ESA

The following Resolutions were adopted:

- Towards Space 4.0 for a United Space in Europe,
- Level of Resources for the Agency's Mandatory Activities 2017-2021,
- CSG (Guiana Space Centre) (2017-2021),
- ESA Programmes

Additionally, a Resolution on setting up the "**ESA Grand Challenge**" was approved in regular Council on 30 November.

The **Resolutions** are available on ESA's website.

The sums allocated by Ministers to allow ESA to reach its future goals can be summarized as follows:

- **Maximise the integration of space into European society and economy** Amount: €2.5 billion
- **Foster a globally competitive European space sector** Amount: €1.4 billion
- **Ensure European autonomy in accessing and using space in a safe and secure environment** Amount: €1.8 billion
- **Foundation: excellence in space science and technology** Amount: €4.6 billion

The same amounts can also be seen spread in a more traditional approach by programme families.

Programme Families	**Total CM16 (M€ at 2016 e.c.)**
Earth Observation	1370 (up to 2025)
Telecom	1280 (up to 2024)
Navigation	69 (up to 2021)
Exploration	1452 (up to 2021)
Prodex (support to Scientific Programme)	172 (up to 2021)
Launchers	1611 (up to 2023)
Space Safety	95 (up to 2022)
Technology	445 (up to 2022)
Science, Research, and Development – ESA Mandatory Activities	3813 (up to 2021)
Total	**10.3 B€**

The figures above include Member States' additional subscriptions to already-running optional programmes not tabled at the Ministerial.

PATH TOWARDS AN AIRLINE PILOT CAREER

Arnaud DINI

Arnaud Dini has been a young member of 3AF since 2014. After being graduated in 2014 with an Associate Degree of Physical Measurements and Materials Science (he made an internship at MBDA), he decided to continue his studies to become an airline pilot. This is a dream coming back to his youth that Arnaud Dini made a reality by his work and will. He gives us an insight of his pilot training experience with a focus on safety and human factors combining theory, training on flight simulators and many hours of flight on different aircrafts.

INTRODUCTION PICTURE

The airline pilot profession remains a childhood dream, challenging due to the selection process as well as the cost of the training. Many private schools, fully recognized and approved by the DGAC and the European Authorities, can lead you to an airline. Recently graduated from one of those, I wanted to share my experience. The choice of a private school remains difficult. Indeed, many FTO (Flight Training Organization) are present on the market, but only a few of them will allow you to get hired by an airline later. I was able to train in one of the best schools, the CAE Oxford Aviation Academy, providing an hiring rate above 90%. With flight schools on four continents, they represent the largest ab initio network in the world. You can either opt for an integrated training (period of 18 months), which was my case, or a modular training, allowing more flexibility for the student pilot. After obtaining my High School Diploma in Science with honors, followed by an Associate's Degree of Physical Measurements and Materials Science at the University of Paris-Jussieu, I decided to buff up on my english skills. To do so, I followed an intensive English Training in Santa Barbara (California) as I believe that a very good English level is mandatory for anyone who is willing to start an airline pilot career. After I successfully passed the selection process, I started my training at CAE Brussels (former training center of the Sabena, Belgian National Airline until 2001). The assessment includes Theoretical Physics tests, English tests, Psychological Interview, COMPASS Tests (psycho-motor and psycho-technical tests, assessing verbal reasoning, mathematics, physics…) and a basic simulator test (used to check movements coordination and multi tasking ability). With a class of 11 students, I initially studied the 14 theoretical subjects of the ATPL (Airline Transport Pilot License) for a period of 6 months. Principles of Flight, Meteorology, Flight Planning, Mass and Balance, Jet Engines ... those were the exciting topics taught (see picture 1). Thanks to expert instructors who bring real world experience into the classroom (active Airline Pilots, former Flight Engineers or Air Traffic Controllers), I passed successfully the 14 subjects of the ATPL with a global average score over 90%.

Then comes the practical training, a « one in a lifetime » experience. Upon successful completion of the theoretical phase, the better was yet to come, the flight training. To achieve this, I carried on my training at CAE Phoenix in Arizona. This states of the USA attracts many schools. As a matter of fact, several airlines train their cadets (Lufthansa, Air Algeria, EVA Air...). The outstanding conditions make that place the best spot to fly. The very good meteorological conditions allow intensive flights (1 or 2 daily flights) and a total immersion in the American culture enables a swift and efficient progress for a period of 6 months. CAE trains its pilots on PA28-181TX (single engine aircraft, see picture 2) equipped with the latest technologies, including: G1000 Glass Cockpit (see picture 3), TAS (Traffic Advisory System) allowing traffic advisories by calculating the range, altitude and bearing of the intruder aircraft.

Each cadet follows an accurate program during his training in the USA, enabling us to acquire the mandatory skills for the Commercial Pilot License (CPL). My experience as a private pilot was a real asset and helped me through the initial phase of the training. Ranging from general air work, simulated asymmetric flight or visual navigation... those were some of the skills each student pilot had to demonstrate to pass their CPL. Finally, after obtaining the required flight hours on single-engine aircraft, we ended-up the training on

Picture 1: ATPL Theoretical Books Library

Picture 2 : PA28, at our home base, Falcon Field Airport

Picture 3 : Glass Cockpit G1000

twin-engine aircraft. Lasting for about ten hours, I had the opportunity to fly on a Piper 44 (Seminole, see picture 4), in order to get ready for the CPL Skill Test.

Indeed, the CPL skill test must be flown on a « complex aircraft », defined as an aircraft with retractable landing gear and a variable pitch propeller (passing the CPL on a complex single engine aircraft is also a possibility).

Flying such a powerful aircraft for the first time will remain a memorable experience. Varying from take-off acceleration, or the management of the variable-pitch propellers along with asymmetric flight following an engine failure.

The Integrated training also includes 3 hours on the Extra 300L (Aerobatic Aircraft, see picture 5) that I flew with a former fighter pilot of the US Army.

Picture 4 : PA44, twin engine

"Upset Prevention and Recovery Training: UPRT »is designed to develop lifesaving skills, close gaps in knowledge and fill in missing elements of manual handling capabilities. We learnt correct relationships between stall speed, angle of attack and load factor, and how to appropriately manage G. The number one cause of fatal accidents across all categories in aviation is Loss of Control In-flight (LOC-I). Nothing else can reduce the risk of LOC-I more than the mitigating effects taught during UPRT. Following this program at early stage of our training provided us a broad-spectrum understanding of various threats present in aviation industry.

After succeeding the CPL, the next step of the training is the Instrument Rating (IR). The sole purpose of this rating is to carry out flights with reference to the on-board instruments. This allows us to operate the aircraft in adverse weather conditions (Low visibility, low ceiling...). Instruments flight requires a very accurate flying technique, leaving little

Picture 5 : Extra 300L, upside down

room for mistakes. In my opinion, this phase of the training is the most complex. Indeed, flying in a challenging environment requires an in-depth knowledge of several technical matters. For instance, every pilot must be able to read an IFR Approach Procedure. This can either be a precision approach, ILS (Instrument Landing System) or non precision approaches (VOR, NDB…). Many crucial informations are provided and every pilot must gather those informations quickly. Accordingly, we spent a lot of hours in a FNPTII (Flight Navigation and Procedure Trainer), which is in other words, a fixed-base simulator. This allows us to reproduce various weather conditions and situations (low visibility procedures, failures, traffic advisories…). Training on a daily basis in this fancy tool was definitely an asset. We kept on enhancing our knowledge of procedures, air law and our flying skills. After a couple of demanding sessions in the simulator (2 simulator sessions followed by a flight, and so on) we applied this knowledge in the real aircraft. We flew on the Diamond 42-TDI, twin engine aircraft (see picture 6) equipped with among other options, anti-ice system, Autopilot or a Stormscope (depicts thunderstorms on the Multi Function Display of the G1000).

Flying the DA42 was a real pleasure, although each flight was physically and mentally exhausting. Indeed, every flight is different, ATC instructions can shift rapidly depending on the traffic, so we had to react swiftly and adapt to whole new situation. Besides studying the weather at our destination airport, we must in the mean time, set everything up for the IFR approach, give a briefing, complete some checklists, navigate, comply with ATC… As all flights were carried out as « single pilot operations » (unlike jet aircrafts requiring 2 crew members) managing high work loads remain in my view the biggest challenge of the IR (all the approaches were flown without autopilot, and engine failure drills were part of the training).

To put it in a nutshell, my first IMC flight (Instrument Meteorological Conditions) will remain an unforgettable memory.

Picture 6 : DA42-TDI at our home base, Antwerp Airport

We took-off in pouring rain, climbed through a thick layer of nimbostratus (rain-bearing cloud) and finally soared above the cloud layer. Contemplating clear blue skies as far as our eyes could see (see picture 7), this magical feeling confirms once more my passion for this stunning profession.

Picture 7 : DA42 cruising above the clouds

Finally, the last and best part of this training will remain the MCC / JOC (Multi Crew Concepts and Jet Orientation Course). This crucial step in the training of an airline pilot, emphasizes the importance of synergy in the cockpit. The CRM (Crew Resource Management), highlights the importance of working as a team. Consequently, we were trained to use all available ressources to reduce errors (work with cabin crew, ATC…). One of the golden rule being :« Speak UP! », if you would have any doubt about something, your duty as a pilot is to talk about whatever worries or concerns you may have, this is a substantial behavior. Therefore, effective crew communication and supportive behavior is the key to success. So as to implement those principles, I flew 28 hours on the Boeing 737-800NG (see pictures 8 and 9). CAE provides full flight simulators of last generation (Level D), mounted on hydraulic actuators, reproducing identically the sensations felt during a real flight. Before entering the simulator, we had to train on SOP's (Standard Operating Procedures). To do so, we trained in a Mock Up (Reproduction of a Cockpit in 2D), in order to memorize the sequence of all the procedures. The last step before entering the simulator is the training in the MFTD (Maintenance and Flight Training Device). This is a cockpit made of touch-sensitive screens. It has a fully operational flight and engine instrument display, meaning that it reacts as it would in the aircraft. The sole purpose of the MFTD is to train on the SOP's and become familiar with all the systems of the B737 (autopilot, FMC…).
Many airlines use it to save costs as the full flight simulator

Picture 8 : MFTD B737-800NG

(FFS) is expensive to rent. As a consequence, every pilot enters the FFS well prepared and no waste of time is involved. Obviously, the most difficult part is within the simulator itself. Indeed, we must fly this beautiful machine of more than 60 tons, while applying Boeing SOP's, work on effective communication, deal with any abnormal situations…

Picture 9 : Full Flight Simulator of the B737-800

Most of the procedures we trained on were flown « Raw Data », meaning, without the help of the autopilot nor the flight directors (attitude required to follow a trajectory). This involves a very good knowledge of the Pitch & Power table. Every thrust setting corresponds to a specific body attitude in clean configuration and at different flap angles. Knowing those data is essential for a safe operation of this aircraft. The B737 will remain the best memory of all my training. Dealing with engine fire, pilot incapacitation, rapid decompression of the cabin... those represent some of the abnormal procedures we had to face. Being confronted with such stressful situations enabled me to realize the importance of CRM. Very proud to complete my training in one of the best schools, I am now seeking for a first officer position in an airline. CAE has several partnerships and is recognized by many airlines for the quality of the training of its pilots. I hope I will be able in the near future to make this work environment my future office, and I am looking forward to welcoming you aboard.

2017

09-13 January • **AIAA** – AIAA SciTech 2017 Science and Technology Forum and Exposition – Grapevine, TX (USA) Hotel Gaylord Texan – www.aiaa-scitech.org

26 January • **RAeS** – BREXIT: The Legal and Operational Implications – Risks and Opportunities – London (UK) – RAeS/HQ – www.aerosociety.com/events

01-02 February • **SEE/3AF** – MEA 2017 – Toulouse (France) – Palais des Congrès – www.see.asso.fr/

05-09 February • **AAS/AIAA** – 27th AAS/AIAA Space Flight Mechanics Meeting – San Antonio, TX (USA) – Marriott Plaza – www.space-flight.org/

07-09 February • **EASA** – Global Manufacturing Conference – Cologne (Germany) – EASA/HQ – https://www.easa.europa.eu/

08-09 February • **ICAO** – ICAO alternative Fuels Seminar – Montréal (Canada) – St John's Antigua and Barbuda – www.icao.int/Meetings/

13-14 February • **ESA** – 3rd ESA International Security Symposium – Frascati (Italy) – ESA/ESRIN www.esaconferencebureau.com/list-of-events

14-18 February • **Aero India** – Aero India 2017 – Bengaluru (India) – Yelahanka AFS – www.aeroindia.in/

16 February • **RAeS** – Humanitarian Aerospace – London (UK) – RAeS/HQ – www.aerosociety.com/events

28 February – 5 March • **AVALON** – Australian International Air Show – Geelong VIC (Australia) - Avalon Airport www.airshow.com.au/

04-11 March • **IEE** – IEEE Aerospace Conference – Big Sky, MT (USA) – Yellowstone Conference Center www.aeroconf.org/

06-09 March • **AIAE** – 21st AIAA International Space Planes and Hypersonic Systems – Xiamen (China) University Xiamen – www.aiaa.org

07-09 March • **CANSO** – World ATM Congress 2017 – Madrid (Spain) – IFEMA Feria de Madrid www.worldatmcongress.org/2017

14-16 March • **IATA** – 11th World Cargo Symposium - Abu Dhabi (UAE) – National Exhibition Centre www.iata.org/events/

21-22 March • **CLEAN SKY** – Clean Sky Forum – Brussels (Belgium) – www.cleansky.eu/event/

27-29 March • **3AF** – 52nd 3AF International Conference on Applied aerodynamics progress in Flight Control Lyon (France) – ECL – http://3af-aerodynamics.com

03-06 April • **Space Foundation** – 33rd Space Symposium – Colorado Springs, Colorado (USA) – Space Foundation/HQ – http://www.spacesymposium.org/

03-06 April • **ERCOFTAC** – European Drag Reduction and Flow control Meeting – Monte Porzio Cantone –Italy) Villa Mondragone – www.ercoftac.org/events

03-07 April • **EUROTURBO** – 12th European Turbomachinery Conference (ETC) – Stockholm (Sweden) – KTH www.euroturbo.eu

05-08 April • **AERO Friedrichshaffen** – AERO Friedrichshaffen 2017 – Messe Friedrichshaffen - www.aero-expo.com

11-13 April • **NBAA** – ABACE 2017 – Asia Business Aviation Conference & Exhibition – Shanghai (China) Shanghai Hongqiav Airport – www.abace.aero

24-25 April • **RAeS** – The Architecture of Air Travel. Designing for Human Behaviour – London (UK) – RAeS/HQ www.aerosociety.com/events

24-26 April • **IATA** – Safety and Flight Ops Conference – Seoul (South Korea) – Grand Hyatt Hotel www.iata.org/events

25 April • **Financial Times** – Business of Aerospace and Aviation Summit – Digital Disruptive Technologies – London (UK) – Hilton Tower Bridge Hotel – http://live.ft.com/Events/2017

25-27 April • **CEAS** – EuroGNC 2017 – 4th CEAS Specialist Conference on GNC – Warsaw (Poland) – WUT http://www.ceas-gnc.eu/

16-18 May • **ICAO/ACI** – Wildlife Strike Hazard Reduction Symposium – Monréal (Canada) – ICAO/HQ www.icao.int/Meetings/

16-18 May • **IATA** – Aviation Fuel Symposium – St Petersburg (Russian Federation) – Park Inn Pribaltiyskaya www.iata.org/events

22-24 May • **EBAA** – EBACE 2017 – Geneva (Switzerland) – Palexpo – www.ebace.aero/2017

29-31 May • **AESS/IEEE** – 24th Saint Petersburg International Conference on Integrated Navigation Systems – Saint Petersburg – Concern Central SRIE – www.elektropribor.spb.ru

29-31 May • **ERCOFTAC** – DLES 11 Direct and Large Eddy Simulation – Pisa (Italy) – www.ercoftac.org/events

29 May-02 June • **ESA** – 10th International Conference on Guidance, navigation and Control – Salzburg (Austria) – Crowne Plaza Salzburg - www.esaconferencebureau.com/list-of-events

05-10 June • **AIAA** – AIAA AVIATION 2017 Forum - Aviation and Aeronautics Forum and Exposition – Denver, CO (USA) – Sheraton Denver Downtown Hotel – www.aiaa-aviation.org/

05-10 June • **AIAA/CEAS** – 23rd AIAA/CEAS Aeroacoustics Conference – Denver, CO (USA) – Sheraton Denver Downtown Hotel – www.aiaa.org/aeroacoustics/

06-07 June • **FSF/EUROCONTROL** – 5th Annual Safety Forum – Brussels (Belgium) – EUROCONTROL/HQ https://flightsafety.org/event/2017

12-14 June • **ACI** – ACI – Europe 27th General Assembly Congress and Exhibition – Paris (France) – Salle Wagram www.aci-europe-events.com

13-14 June • **RAeS** – Benchmarking for Improving Flight Simulation – London (UK) – RAeS/HQ www.aerosociety.com/events

13-15 June • **3AF/SEE** – ETTC'17 – Toulouse (France) – Centre de Congrès Pierre Baudis. https://www.see.asso.fr/

25-28 June • **EUROMECH** – Euromech Turbulence Conference (ETC) 2017 – Porto (Portugal) – University – Faculty of engineering – www.euromech.org

AMONG UPCOMING AEROSPACE EVENTS - **End 017**

19-25 June • **ISAE/GIFAS** – IPAS 2017 International Paris Air Show – Le Bourget Airport – www.siae.fr

27-29 June • **3AF** – IAMD 12 – 12th International Conference 3AF Integrated Air and Missile Defence – Stockholm (Sweden) – http://3af-integratedairmissiledefence.com

10-12 July • **AIAA** – AIAA Propulsion and Energy 2017 forum – Atlanta, GA (USA) – Hyatt Regency www.aiaa-propulsionenergy.org

12-14 September • **AIAA** – AIAA SPACE 2017 Forum – Orlando, FL (USA) – Hyatt Regency – www.aiaa-space.org

12-15 September • **ERF** – ERF2017 – 43rd ERF – Milan (Italy) – Politecnico di Milano – Campus Bovisa https://www.erf2017.org

18-22 September • **COSPAR** – 3rd Symposium COSPAR – Jeju Island (South Korea) – ICC Jeju https://cosparhq.cnes.fr

25-29 September • **IAF** – 68th International Astronautical Congress – Adelaide (Australia) – Adelaide Convention Centre www.aiaa-space.org

03-05 October • **Aviation Week** – MRO Europe 2017 – London (UK) – Excel London www.mroeurope.aviationweek.com/

10-11 October • **AAE** – International Conference "Climate Needs Space" – Toulouse (France) – Congress Centre Meteo – France – www.academieairespace.com

16-20 October • **CEAS** – Aerospace Europe 2017 Conference – 6th CEAS Air & Space Conference – Bucharest (Romania) Parliament of Romania – www.ceas2017.org

25-29 October • **ESA** – 6th international Colloquium on Scientific and Fundamental Aspects of GNSS/Galileo – Valencia (Spain) – TU Valencia – http://esaconferencebureau/list-of-events