CEAS
Council of European Aerospace Societies

BULLETIN AEROSPACE EUROPE

FUTURE COMBAT AIR SYSTEM, FCAS

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CEAS

The Council of European Aerospace Societies (CEAS) is an International Non-Profit Organisation, with the aim to develop a framework within which the major European Aerospace Societies can work together.
It was established as a legal entity conferred under Belgium Law on 1st of January 2007. The creation of this Council was the result of a slow evolution of the 'Confederation' of European Aerospace Societies which was born fifteen years earlier, in 1992, with three nations only at that time: France, Germany and the UK.

It currently comprises:

- 11 Full Member Societies: Czech Republic (CzAeS) – France (3AF) – Germany (DGLR) – Italy (AIDAA) – The Netherlands (NVvL) – Poland (PSAA) – Romania (AAAR) – Spain (AIAE) – Sweden (FTF) – Switzerland (SVFW) – United Kingdom (RAeS);
- 5 Corporate Members: ESA, EASA, EUROCONTROL, EUROAVIA, von Karman Institute;
- 9 Societies having signed a Memorandum of Understanding (MoU) with CEAS: AAE (Air and Space Academy), AIAA (American Institute of Aeronautics and Astronautics), CSA (Chinese Society of Astronautics), EASN (European Aeronautics Science Network), EREA (European association of Research Establishments in Aeronautics), ICAS (International Council of Aeronautical Sciences), KSAS (Korean Society for Aeronautical and Space Sciences), PEGASUS (Partnership of a European Group of Aeronautics and Space Universities) and Society of Flight Test Engineers (SFTE-EC).

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

AEROSPACE EUROPE

Since January 2018, the CEAS has closely been associated with six European Aerospace Science and Technology Research Associations: EASN (European Aeronautics Science Network), ECCOMAS (European Community on Computational Methods in Applied Sciences), EUCASS (European Conference for Aeronautics and Space Sciences), EUROMECH (European Mechanics Society), EUROTURBO (European Turbomachinery Society) and ERCOFTAC (European Research Community on Flow Turbulence Air Combustion).
Together those various entities form the platform 'AEROSPACE EUROPE', the aim of which is to coordinate the calendar of the various conferences and workshops as well as to rationalise the information dissemination.
This new concept is the successful conclusion of a work which was conducted under the aegis of the European Commission and under its initiative.
The activities of 'AEROSPACE EUROPE' will not be limited to the partners listed above but are indeed dedicated to the whole European Aerospace Community: industry, institutions and academia.

WHAT DOES CEAS OFFER YOU ?

KNOWLEDGE TRANSFER:
- A structure for Technical Committees

HIGH-LEVEL EUROPEAN CONFERENCES:
- Technical pan-European events dealing with specific disciplines
- The biennial AEROSPACE EUROPE Conference

PUBLICATIONS:
- CEAS Aeronautical Journal
- CEAS Space Journal
- AEROSPACE EUROPE Bulletin

RELATIONSHIPS AT EUROPEAN LEVEL:
- European Parliament
- European Commission
- ASD, EDA, OCCAR

HONOURS AND AWARDS:
- Annual CEAS Gold Medal
- Medals in Technical Areas
- Distinguished Service Award
- CEAS Most Cited Paper Awards

YOUNG PROFESSIONAL AEROSPACE FORUM SPONSORING

AEROSPACE EUROPE Bulletin

AEROSPACE EUROPE Bulletin is a quarterly publication aiming to provide the European aerospace community with high-standard information concerning current activities and preparation for the future.
Elaborated in close cooperation with the European institutions and organisations, it is structured around five headlines: Civil Aviation operations, Aeronautics Technology, Aerospace Defence & Security, Space, Education & Training and Young Professionals. All those topics are dealt with from an overall European perspective.
Readership: decision makers, scientists and engineers of European industry and institutions, education and research actors.

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EDITORIAL

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Dear readers,

On the title page of this issue of the AEROSPCE EUROPE Bulletin, we have included a graphic showing elements of the Future Combat Aircraft System (FCAS), that is a key instrument for ensuring European sovereignty in defence and security. FCAS will be built around a core Next Generation Weapon System (NGWS). In this "system of systems," piloted New Generation Fighters will work together with Unmanned Remote Carriers – all connected to other systems in space, in the air, on the ground, at sea and in cyberspace via a data cloud called the "Combat Cloud." These connected platforms will act as sensors, effectors and C2 nodes, enabling agile decision making and working together within an open, scalable, service oriented architecture that allows the inclusion of future platforms and technologies. Worth to mention, that the NGWS program has been designed with a clear and collaborative framework, ensuring that roles, responsibilities, and leadership are well-defined and allocated based on the principle of leveraging the strengths of each partner.

Given the importance of this topic for the enhancement of European security and the development of aerospace technology, we have included an interesting interview with Philippe KOFFI, Head of Joint French, German and Spanish Team in charge of the FCAS Programme Management at the Direction générale de l'armement (DGA). Since May 2023, he has in charge the preparation of the future air, naval and land combat systems, including Next Generation Weapon System (NGWS) and Main Ground Combat System (MGCS).

You will also find a fascinating article on Artificial Intelligence: current state, development, challenges and risks This article was written by Claude Roche, former Vice-President of the Academy of Air and Space, Paris. You can read that "Current AI developments are still mainly human-driven, with only a marginal and complementary input from machine learning."

In this issue you can read an interesting article on comparison of standards and guidelines in use in the different IAQG sectors prepared by a very talented group of specialists from the European Space Agency, RAFAEL Center for Innovative Space Systems and the European Aerospace Quality Group / International Aerospace Quality Group Space Forum.

In the area of education and training, we have included an article on Virtual Labs in aerospace engineering education, written by Jorge García Tiscar on behalf of the PEGASUS network. A recent symposium on aerospace engineering education highlighted the challenges and advantages of implementing these innovative learning tools, enabling new Master's programs, inclusive access to education, and opportunities across frontiers.

Among the other information in this issue of the AEROSPACE EUROPE Bulletin, you will find an update on two important conferences organised by the CEAS. The first is the 4th International Conference on High-Speed Vehicle Science and Technology, to be hosted by the 3AF (French Aeronautics and Aerospace Society) in Tours, France from 22 to 26 September 2025. The second is the 10th CEAS Aerospace Europe Conference, to be held in Turin, Italy, from 1 to 4 December 2025. This conference will be hosted by the Italian Association of Aeronautics and Astronautics (AIDAA) and will be organised as a joint event with the 28th AIDAA International Congress. It will also coincide with the 10th Aerospace & Defense Meetings, providing a unique stage for industry and academic collaboration. We look forward to welcoming you to these conferences.

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CONTENTS

• CEAS PRESENTATION
– Members and Partners 2-4
– Editorial 5
– CEAS President message 6

• LIFE OF CEAS
– President's report for year 2024 Franco Bernelli Zazzera, CEAS President 2021-2024 7-9
– CEAS tribute to Dr-Ing Jean-Pierre Sanfourche 10-11

• PERSONALITY INTERVIEW
– Interview with Philippe Koffi, French Armament Procurement Agency (DGA) By Łukasz Kiszkowiak, Deputy Editor-in-Chief AEROSPACE EUROPE Bulletin 12-15

• POINT OF VIEW
– Artificial intelligence: current state, development, challenges and risks By Claude Roche, former Vice-President of the Academy of Air and Space 16-17

• AERONAUTICS TECHNOLOGY
– Review of the 58th 3AF International Conference on Applied Aerodynamics By Eric Chaput (President of the 3AF Aerodynamics Technical Committee) 18-19
– The 4th International Conference on Hihgt-Speed Vehicle Science & Technology 20-21
– CEAS AEC / AIDAA 2025 22-23

• SPACE
– Comparison of standards and guidelines in use in the different IAQG sectors 24-28

• EDUCATION AND TRAINING
– virtual labs in aerospace engineering education 29-31

• CEAS JOURNALS
– CEAS Space Journal 32-33
– CEAS Aeronautical Journal 34-37

• EVENT CALENDAR
– Among Upcoming Aerospace Events 38-40

PRESIDENT'S MESSAGE 2025

Dr.-Ing. Cornelia Hillenherms
President of CEAS 2025

Dear CEAS Society Members,
Interested Readers, and Friends,

I am honoured to have been elected as CEAS president for 2025, and I look forward to working even more intensively together with the people on the Board, in the Technical Committees and in the community.

We ended last year in sadness due to the loss of one of our longest-serving and most engaged CEAS friends, Jean-Pierre Sanfourche, who was Editor-in-Chief of this Bulletin since its beginning. In this issue, we are doing our best to continue the work that Jean-Pierre did so perfectly and for a long time with much enthusiasm and dedication. I would like to wholeheartedly thank the outgoing CEAS president, Prof. Franco Bernelli Zazzera, who served CEAS for the last four years. He led the Council in an outstanding way and worked consistently to enhance the services and visibility of CEAS to its members and to the aerospace community. I will continue to build on CEAS' strengths. But what are the major strengths?

- CEAS represents most European countries with activities in the Aerospace sector and, through its member structure, offers a neutral forum for experts from academia, research institutions, industry and politics.

- CEAS has created opportunities for knowledge exchange and dissemination through a number of very successful, highly ranked specialist conferences. These conferences are organised by CEAS' technical committees, who also ensure that their members represent industry, academia and research organisations equally. I believe that this is one reason for their success.

- CEAS runs two successful international journals, the CEAS Aeronautical Journal and the CEAS Space Journal. Both are recognised for presenting new developments and outstanding results in the field of aeronautical and space science and technology and are indexed in Scopus. The CEAS Space Journal has already been included in Clarivate's "Emerging Sources Citation Index" in 2023, so there is now an official Impact Factor. The CEAS Aeronautical Journal is currently in the application process.

When talking about strengths, I think we also have to address CEAS' weaknesses. In my opinion, the biggest weakness is the low visibility of CEAS. There is clearly room for improvement by more actively sharing information on CEAS' activities and by inviting more people directly to participate and to make use of CEAS' services. CEAS is not an end in itself, but a vital opportunity for networking and consolidation at European level. In the current times of growing geopolitical uncertainty and pressing challenges, such as the decarbonisation of the air transport system or the space debris mitigation, this is more important than ever. We must work together, industry, research institutions and universities, to solve these problems. CEAS is the forum for the exchange and discussion of the necessary joint activities, fostering the dialogue and stronger collaborations across the different stakeholders, and supporting the next generation of aerospace engineers and scientists.

In this context, I would like to invite you to join the next Aerospace Europe Conference, which will take place from 1 – 4 December 2025 in Turin, Italy. I look forward to seeing you there!

Thank you for your continued commitment to advancing Aerospace in Europe and beyond! I wish you all a prosperous and inspiring 2025.

Cornelia Hillenherms – President of CEAS 2025
Cologne, 10 January 2025

PRESIDENT'S REPORT FOR YEAR 2024

Franco Bernelli Zazzera
CEAS President 2021-2024

This has been my fourth term as CEAS President. It was a privilege and a pleasure to act as CEAS President for four terms, working with all the persons involved in the CEAS Board of Trustees, in the CEAS Journals and in the CEAS Technical Committees. It is always great to work with persons that devote their time and effort for the benefit of the community and not for personal interest. I truly believe that this will continue, in support of the incoming new **CEAS President, Cornelia Hillenherms**.
This year has seen CEAS bringing forward some initiatives approved during 2023, in particular the assignment of DOIs to conference papers and bringing fully operational the CEAS repository for all CEAS conferences, and supporting several thematic conferences organised by the CEAS Technical Committees. New procedures for the nomination of the CEAS President have also been decided and adopted, as reported in the "CEAS AT WORK" section of this report.

Very sadly, the year ended with the premature death of Jean-Pierre Sanfourche, editor in chief of the Aerospace Europe Bulletin. The CEAS Board of Trustees values the experience that Jean-Pierre has brought to CEAS and will work hard to continue the endeavours that Jean-Pierre started and carried forward with passion, dedication and great enthusiasm. He will not be forgotten.

CONFERENCES

HiSST 2024
The 3rd HiSST Conference was held on the 14th – 19th of April in Busan, Korea. The conference included 236 papers, 7 keynote speeches, 4 workshops and 21 posters, with 363 attendees from 24 countries. Oral presentations were distributed in 48 sessions. After the delays un uncertain scenario that affected the 2nd HiSST, the conference is now in a very good shape and back on track. Selected papers will be published on a special issue of CEAS Space Journal.

AIAA/CEAS Aeroacoustics Conference 2024
The 30th AIAA/CEAS Aeroacoustics Conference (Aeroacoustics 2024) was held from 4th to 7th of June in Rome, hosted by University Roma Tre, with a pre-conference Aeroacoustics Course on 3rd of June. The conference included 426 papers, distributed in 12 parallel sessions. This has been the most successful ever Aeroacoustics conference. The total number of registered participants reached the remarkable level of 541, including 140 PhD students. The event has been the occasion to assign the CEAS Aeroacoustics Award to Pieter Sijtsma and the AIAA Aeroacoustics Award to Krishnamurthy K. Viswanathan. Among the papers, the Best student paper award was assigned to Levent Ugur, while the Best paper award was assigned to Simon Bouley, Joannès Chambon and Olivier Minck. The Gala Dinner of the conference has given CEAS the opportunity to celebrate the CEAS Gold Award 2023 and the CEAS Distinguished Service Award 2023. The pre-conference course on Aeroacoustics of Low-Mach Number Flows was attended by over 100 participants.

EuroGNC 2024
The EuroGNC 2024 Conference was held on the 11th – 13th of June in Bristol. The conference included 66 papers coming from the regular review process and 9 invited papers, with around 140 attendees. Among all papers, the EuroGNC Best Paper and Marc Pélegrin's Award has been assigned to Lasse Shala, Shubham Vyas, Mohamed Khalil Ben-Larbi, Shivesh Kumar and Enrico Stoll from the German Research Center for Artificial Intelligence.

IFASD 2024
The IFASD 2024 Conference was held on the 17th – 21st of June in The Hague. The conference programme included 56 sessions, with 177 presentations and 23 posters, with 271 attendees, including 64 students, from 26 countries. The Student Paper Prize was awarded to Stefanie Dussler from Imperial College.

ERF 2024
The 50th European Rotorcraft Forum, ERF 2024, was held on the 10th – 12th of September in Marseille. The conference included 159 papers, distributed in 47 Technical ses-

sions, with 368 registered participants from 19 countries. The Padfield Award for the ERF best young author paper prepared for and presented at the European Rotorcraft Forum ERF was assigned to Madeline Fischer from the University of Maryland. Selected papers will be published on a special issue of CEAS Aeronautical Journal.

AEC-2025

The Aerospace Europe Conference 2025, joint 10th CEAS conference, 10th Aerospace & Defense Meeting and 28th AIDAA Conference, will take place in Torino from December 1 to December 4, 2025. The organisation of the event is already under way, with the Call for abstract opening at the end of January 2025. In addition to the regular technical sessions, with topics proposed jointly by CEAS and AIDAA, Special Sessions can be proposed up to July 2025 and it is expected to close the abstract submissions on September 15, 2025. The combination of the three events will make this a high-level gathering of professionals in the aerospace sector. As usual, the event will give CEAS the opportunity to deliver its 2024 Awards.

CEAS AT WORK

The year has been characterised by three Board of Trustees meetings. A fourth meeting, informal, was organised online. The most relevant decisions are briefly discussed hereafter.

The internal organisation of CEAS has been discussed and the CEAS Bylaws have been amended to adapt them to an agreed common practice for the election of the CEAS President. The amended Bylaws now state that "The term of office is in principle one year for the President and two years for the three Vice-Presidents. Any Officer or Trustee may be re-elected, but due regard shall be paid to the desirability of rotation in the composition of the Board. In addition to the election of a CEAS President also a CEAS President-Elect will be elected with the intention that the President Elect will succeed the CEAS President after his term. When no President Elect can be found the president can be re-elected."
The CEAS aerospace repository has been made fully operational and several conference papers are now available for consultation. The conference papers of 2024 will receive a DOI, while older papers will be stored and accessible without a DOI. In order to make papers accessible, a standard set of information has been defined, which will be mandatory to be provided with the pdf paper files. So far, papers from HiSST and IFASD conferences have been uploaded.

CEAS has been active in promoting itself and its journals, setting up a small stand at the ICAS and IAC congresses, the two major aerospace events in Europe during 2024. Informative material has been made available, with roller banners and flyers for the journals and the CEAS and the printed copy of the latest CEAS Aerospace Europe Bulletin. In addition, promotional banners of CEAS and its journals have been displayed during the Aeroacoustics Conference and during HiSST. These actions are intended to strengthen the image of CEAS and have been successful in terms of visibility to the aerospace community.
CEAS has decided to support financially best paper awards for students or young professionals at the CEAS conferences. Following this decision, best paper awards have been assigned at the IFASD, ERF, EuroGNC.

During the ICAS Congress in Firenze, CEAS and ICAS have renewed their Memorandum of Understanding for the cooperation. This Cooperation Agreement is intended to serve for the development of a mutually beneficial scientific, technological, and organizational cooperation between the Parties in aviation and space activities, promotion of developments in aerospace and popularizing the achievements and research in all areas of aeronautics and space. ICAS and CEAS express mutual interest to support exchanges among their members to broaden both organizations' networks and provide opportunities for the exchange of information on relevant topics in the field of aeronautics and aviation research.

CEAS AWARDS

CEAS has provided awards for two outstanding individuals that have contributed greatly to the achievements within the aerospace industry and within CEAS, and to the authors of the most cited papers published on the CEAS Journals.

The CEAS Gold Award for 2024 has been assigned to Mr Georges Bridel, who has provided significant contributions to the development of European military fighter aircraft, including the development of stealth fighter geometries. He has provided great stimuli towards the development of a joint European future fighter aircraft. He was strongly engaged in the support of early career scientists and engineers in an international environment.

Furthermore, he has provided great contributions to the development of CEAS. In 2008 he was CEAS President. In the CEAS conferences of 2011 and 2015 he provided presentations and organized workshops to support the joint European fighter aircraft and the supporting technologies. At present he heads the CEAS Past Presidents Committee and he was involved in the organization of the joint CEAS-EUCASS aerospace conference in Lausanne Switzerland.
The CEAS Distinguished Service Award has been assigned to Mr. Jean-Pierre Sanfourche, for his long-term dedicated service to CEAS and the entire European Aerospace Community as Editor-in-Chief of CEAS Aerospace Europe Bulletin.
I also like to mention the awardees for the most cited journal papers.

For the CEAS AERONAUTICAL JOURNAL:

1. *Eißfeldt, H., Vogelpohl, V., Stolz, M., Papenfuß, A., Biella, M., Belz, J. & Kügler, D.: The acceptance of civil drones in Germany. CEAS Aeronautical Journal, 11(3), pp.665-676 (2020).*
2. *Tam, C.K., Bake, F., Hultgren, L.S. & Poinsot, T.: Combustion noise: modeling and prediction. CEAS Aeronautical Journal, 10, pp.101-122 (2019).*
3. *Seitz, A., Hübner, A. & Risse, K.: The DLR TuLam project: design of a short and medium range transport aircraft with forward swept NLF wing. CEAS Aeronautical Journal, 11(2), pp.449-459 (2020).*

For the CEAS SPACE JOURNAL:

1. *Bruhn F. C., Nandinbaatar T., Kunkel F., Flordal, O & Roxel I.: Enabling radiation tolerant heterogeneous GPU-based onboard data processing in space. CEAS Space Journal, 2020, Volume 12(4), Page 551-564,*
2. *Freeman, A.: Exploring our solar system with CubeSats and SmallSats: the dawn of a new era. CEAS Space Journal, 2020, Volume 12(4), pp.491-502.*
3. *Bellomo N., Magarotto M., Manente M., Trezzolani F., Mantellato R., Cappellini L., Paulon D., Selmo A., Scalzi D., Minute M., Duzzi M. & Barbato A.: Design and In-orbit Demonstration of REGULUS, an Iodine electric propulsion system. CEAS Space Journal, 2022, Volume 14(1), Page 79-90*

GENERAL ASSEMBLY AND BOARD OF TRUSTEES MEETINGS DURING 2024

The General Assembly was held only once, in November, while the BoT Meeting was held three times, in April, September and November. One further BoT meeting, informal, was organised online in June. At the end of the year, the CEAS Officers appointed for 2025 are the following:

- **CEAS President**, Mrs. Cornelia Hillenherms.
- **Vice-President Publications and External Relations**, Mr. Lukasz Kiszkowiak.
- **Elected Vice-President Awards and Membership**, Mr. Anders Blom.
- **Vice-President Finance**, Mr. Philip Nickenig.
- **Director General**, Mr. Andrea Alaimo.
- **Aeronautics Branch Chairman**, Mr. Jonathan Cooper.
- **Space Branch Chairman**, Mrs. Britta Schade.

The major and important decisions that have been taken along the year have been presented in this report.

Prof Franco Bernelli – President of CEAS
Milano, 07.01.2025.

CEAS TRIBUTE TO DR-ING JEAN-PIERRE SANFOURCHE

In October 2002, the CEAS Council decided to strengthen the visibility of CEAS by publishing a Quarterly Newsletter (CEAS Quarterly Bulletin). The CEAS Council felt that CEAS had reached a point where a direct means of communication was needed between its 25,000 members.
This would help to strengthen the growing network of European aerospace researchers. The CEAS Quarterly Bulletin was also conceived as a way of informing CEAS members of European Union research programmes and wider events in the European aerospace community.
From the first CEAS Bulletin, published in the first quarter of 2003 Jean-Pierre was one of the two CEAS Bulletin Edition Coordinators. Jean-Pierre had gained a rich experience and knowledge from his time at CNES the many space projects he had been involved in as well from his activities as Executive Secretary as well as editor-in-chief of the bulletin (La Lettre 3AF) of the Association Aéronautique and Astronautique de France (3AF).

In 2007, he was appointed Editor-in-Chief of the CEAS bulletin, a function he fulfilled with great enthusiasm and competence till his untimely passing away in November 2024. He wrote a one-page editorial for every version.
Furthermore, he held many interviews with personalities from the European Union, the European Aerospace Industry, Research Establishments and universities. He transformed the quarterly 30-page quarterly CEAS Bulletin into a must-read periodical for all the CEAS members and stakeholders in its over 34000 network of aerospace professionals. In 2024, CEAS honoured Jean-Pierre by providing him with the CEAS Distinguished Service Award.

The personal relationship with Jean-Pierre was characterized by a real friendship. In the early days of CEAS in 2000 and beyond, he attended many of the numerous meetings where we have been sometimes challenged by serious problems. His active but calm participation, his serenity, often accompanied with a sense of humour helped quite often to overcome the difficulties. We will miss his comforting attitude very much.
CEAS is very grateful to Jean-Pierre Sanfourche. His activities and initiatives have significantly strengthened CEAS's visibility over the lasttwo decades.
Statements of appreciation have been provided by the CEAS Trustees, and we like to explicitly mention a few of them:

"Jean-Pierre´s meticulous work for CEAS and the CEAS Bulletin is unprecedented and cannot be overestimated. Thanks to Jean-Pierre, the CEAS Bulletin has become a unique source of information and discussion topics on aerospace."

"I am very grateful for Jean-Pierre's efforts in the preparation of the CEAS bulletin and all his work for the CEAS community. His many years of work in this field have enabled a significant increase in the recognition of CEAS in the aviation community. I believe that the personal friendship we had with Jean-Pierre have been a source of enrichment and enjoyment to all of us."

"Jean-Pierre, as editor of the CEAS newsletter, has become a CEAS face. We will miss him very much."

"Jean-Pierre was one of the most dedicated members of our CEAS family and we will miss him much."
"He was an excellent colleague and friend and his excellent work in editing CEAS bulletin will be long time remembered."

"I am very saddened to hear of the death of our dear Jean-Pierre, to whom we owe not only his great work for CEAS but also his impeccable treatment throughout the time he was with us."

"He was truly and entirely kind throughout his entire career and most supportive of all endeavours."

"Unfortunately, I have never got a chance to talk directly with Jean-Pierre. I have been in contact with him several time via e-mail on in web meeting. What is really important for me about Jean-Pierre is the work and dedication he had with the CEAS Bulletin. This is one of the best bulletin I have never read. Jean-Pierre is part of the previous (past, older) generation of CEAS members: he was taking care of CEAS with no-personal interest and/or ambition, just the pleasure to do thing in the best way."

"I always had been close to Jean-Pierre. The most memorable get-together I had with him and his wife next morning after the TBM session of April 18, 2008, in Athens: on the Acropolis! I had taken over the Presidency from Sir Colin Terry. The session lasted from 9'30 a.m. to 18'00 p.m. and we experienced a succession of fundamental difficulties, incomparable to the way of smoothly conducting the CEAS business today. Anyway, we met under the temple, unplanned, and started to laugh! He gave me consolation about yesterday's event, a very good place to do so. I still remember his laughing and we celebrated also some of yesterday's achievements, among them the MoU setting the ground for developing the CEAS Air and Space Journals! We will remember him in the best way."

We like to give one more hint on his dedication and sense of initiative, even if not strictly related to CEAS. In whatever activity he embarked upon, he always was enthusiastic and very open-minded. Playing the piano, he'd decided to take up lessons to still progress. He did this in a Paris music conservatory, so happy to be one of the (teenagers!) pupils until his death!

We will sincerely miss his always positive, stimulating and informative contributions to the CEAS Board Meetings and his great CEAS Editor-in-Chief contributions and leadership.

Franco Bernelli, Fred Abbink, Georges Bridel, Pierre Bescond and Joachim Szodruch, *20 Jan 2025*

I would like to join in the tribute to Jean-Pierre. I am proud and fortunate to have collaborated with him for over 25 years. I will never forget his kindness, his humor, and his positive attitude.

Sophie Bougnon -Graphic designer of Aerospace Europe

INTERVIEW WITH PHILIPPE KOFFI, FRENCH ARMAMENT PROCUREMENT AGENCY (DGA)

By Łukasz Kiszkowiak, Deputy Editor-in-Chief AEROSPACE EUROPE Bulletin

Philippe Koffi, Director of Combat Systems Strategy at the French Armament Procurement Agency

Philippe Koffi is a graduate of Ecole Polytechnique and of ISAE/SUPAERO. He starts his career in 1999 as an engineer in the DGA Hydrodynamics Test Centre.

In 2003 he moves to the Service for the procurement of Aeronautics Programmes as an aircraft LO expert and in 2005 he is also appointed as the technical Architect of the European Neuron UCAV Demonstration Programme. He holds that position till 2008, date on which he is given the management of the Neuron Project.
In 2011, he joins the Strategy Directorate, where he is in charge of the preparation of future combat aeronautics. In particular he is highly involved in the preparation and in the implementation of the Anglo-French UCAS roadmap within the scope of the Lancaster-House treaty signed in 2010.
In 2014, he becomes FCAS/UCAS Programme Director within the Combat Aircrafts and Equipments Management Unit (UM ACE), in order, in particular, to launch and to pilot the Franco-British FCAS Feasibility Phase, which Arrangement was signed in Farnborough on 15 July 2014.
In 2018, he launches the Man Machine Teaming (MMT) study to bring Articial Intelligence technologies into the future fighter cockpit and to federate an innovative ecosystems of startups, SMEs and labs.
After the signature of the Next Generation Weapon System (NGWS/FCAS) Framework Agreement at the 2019 Paris Airshow, he takes the head of the Franco, Germano and Spanish Combined Project Team (CPT) Programme Division and succeeds in the launch of Phase 1B (3bn€).
Since May 2023 he has in charge the preparation of the future air, naval and land combat systems including NGWS and MGCS.

On 15 December 2022, the French Armament Procurement Agency (DGA) signed the contracts with industry of the 'Phase 1B-2' of the Future Combat Air System (FCAS), covering a 3-year period, i.e. until early 2026. We are therefore at the beginning of the second half of this contract so that it is quite opportune to review with you its state of advancement.

First of all, is the industrial organisation functioning in perfect accordance with the initial set up based upon the respect of key principles that are clear allocation of responsibilities end leadership, direct access and full visibility for all stakeholders?
The NGWS program has been designed with a clear and collaborative framework, ensuring that roles, responsibilities, and leadership are well-defined and allocated based on the principle of leveraging the strengths of each partner. While the industrial organization has seen notable progress with several critical milestones achieved, it operates in a complex multinational environment, where differences in priorities and expectations occasionally arise.
Building trust is a gradual process in a program of this scale and ambition. Over time, through consistent collaboration, shared problem-solving, and alignment on objectives, the program is fostering deeper understanding and mutual confidence among partners. This evolving trust, combined with ongoing efforts to refine governance structures and enhance transparency, supports a balanced approach that respects the sovereignty and interests of all stakeholders.

A key enabler of this collaboration is the Collaborative Working Environment (CWE), which serves as a cornerstone for the program's operational cohesion. This advanced digital framework has been instrumental in streamlining exchanges among partners, securing sensitive data, and ensuring data continuity. By centralizing information and harmonizing processes, the CWE fosters a transparent and efficient working dynamic that underpins the program's ability to adapt and progress, even in challenging circumstances.
The NGWS program remains committed to fostering innovation and efficiency through this collaborative framework. While challenges are an inherent aspect of such a complex endeavor, we are confident they will be addressed effectively to ensure the program's success.

At which state of progress are we at overall system level on the one hand and on the other hand in each of the 7 pillars: main achievements, major milestones (in particular Preliminary Design Reviews), TRL, critical points, risks, human resources, etc.
The NGWS program is currently 22 months into Phase 1B, and significant progress has been made across three main areas of work: system and system-of-systems concept studies, demonstrator developments, and technology maturation activities. This phase is characterized by the involvement of 3000 engineers across the three partner

nations and the successful delivery of several hundred key deliverables. Critical reviews have also been passed, demonstrating the program's steady advancement.

1. System and System-of-Systems Concept Studies: We are now entering the final iteration of the NGWS architecture evaluations, which will culminate in 2026 with the selection of a single reference architecture. This architecture will combine a concept for the New Generation Fighter (NGF) and concepts for both Reusable and Expandable Remote Carriers (RCs). These studies are essential to preparing for the development of operational assets and ensuring the integration of the system-of-systems approach.
2. Demonstrator Developments: In March 2024, the Concept Selection Review (CSR) for the NGF demonstrator was successfully completed. This milestone represents a major step in finalizing the design and preparing for the first flight of the demonstrator in 2030. For the Remote Carrier demonstrators, preparations are well underway, with their respective CSRs expected to be completed in the coming weeks. These demonstrators are critical for validating key technologies and reducing risks before moving into full-scale development.
3. Technology Maturation: The program's technological innovation is thriving, with numerous laboratory tests conducted, particularly in the Sensors Pillar, where cutting-edge advancements are being explored. To foster innovation further, over 90 Non-Traditional Players—including startups, labs, and SMEs—have been engaged through dedicated technology tokens. This approach has expanded the program's innovation ecosystem and introduced new perspectives and expertise.

There is one core NGWS but this NGWS extends to 3 national FCAS which also include national systems (France, Germany, Spain). What is the present status of this multinational concept?

National FCAS (Futur Combat Air Systems) are indeed built around the NGWS as its core, comprising the New Generation Fighter (NGF) and the Remote Carriers (RC). However, they extend beyond this to include a broader set of national systems, such as manned and unmanned platforms from the first circle (combat platforms) and the second circle (support platforms, like the MRTT). To ensure operational, technical, and timeline coherence across this framework, each nation has initiated national studies. These studies aim to align the respective roadmaps of all platforms and to develop end-to-end functional chains that integrate seamlessly within the overarching system-of-systems architecture.

In the French context, it is important to highlight that the first operational milestone of the SCAF (Système de Combat Aérien Futur) will be the Rafale F5, supported by the UCAV, whose developments have just been launched. These platforms will lay the groundwork for the full implementation of the SCAF, providing early operational capabilities while ensuring compatibility with the NGWS.

How is the FCAS/NGWS overall programme governed at DGA? What are the relationships between the Governance Team and EC, EDA and OCCAR?

The governance of the NGWS program was formalized with the signing of the Framework Arrangement in June 2019 between the partner nations, establishing a clear and collaborative structure to guide the program.

At the highest level, the program is directed by a Steering Committee (SC), which comprises one representative from each partner nation. This committee meets every two months in a rotating location to define the program's strategic orientations. On the French side, the governance of the project is shared between the DGA and the French Air and Space Force, allowing for two representatives from France in the Steering Committee. This bicameral approach ensures that both technical and operational perspectives are fully represented.

To manage the program's day-to-day activities, a Combined Project Team (CPT) has been established. This international team includes around 40 representatives from France, Germany, and Spain who work in a co-located environment in Southern Paris. The primary role of the CPT is to align national inputs and reach compromises, enabling a unified voice when engaging with industry. The CPT relies on contributions from national teams in each country, which consolidate their respective analyses and operational needs.

The DGA serves as the contracting authority for the program, managing and amending contracts under French law. This ensures legal consistency and facilitates efficient oversight of industrial contributions. France was designated as the lead nation for the NGWS program in 2018, and this leadership role underpins the program's governance structure during this early phase.

As the program is still in its conceptual and definition phase, the focus remains on consolidating operational requirements, refining concepts, and defining system specifications. The current governance model, under French leadership, is deemed the most effective for these tasks. However, once the program transitions to Phase 2 and the specifications are finalized, we plan to re-evaluate the governance model with our partners to determine the feasibility of transitioning the program to OCCAR for further phases. This could align with the evolving needs of the program and its stakeholders.

The European Commission (EC) plays complementary roles in the broader context of European defense programs. The NGWS program benefits directly from the European Defence Fund (EDF), supporting two major projects: EPIIC (focused on future smart and operational cockpit) and EICACS (dedicated to collaborative combat systems). These projects not only strengthen the technological base of the NGWS but also ensure alignment with broader European defense objectives. By leveraging these initiatives, the program benefits from enhanced funding, innovation, and strategic coherence.

It is foreseen that immediately after completion of Phase 1B, the Phase 2 will follow without transition, but under the condition of a formal agreement between the industrial companies involved in Phase 1B. Could you give us some information about its budget, main objectives and planning of this Phase 2?

The transition from Phase 1B to Phase 2 of the NGWS program is planned for 2026, ensuring continuity in the program's momentum. With a budget of €4.5 billion shared between France, Germany, and Spain, Phase 2 is a pivotal step that will build on the achievements of Phase 1B. This phase will focus on the development and validation of critical demonstrators, both ground-based and in-flight, to solidify key trade-offs and collect essential data for simulation tools. Specifically, it will involve the development, manufacturing and assembly of three flight demonstrators: the NGF demonstrator (NGFD), which will address major trade-offs such as stealth and manoeuvrability, and two RC demonstrators (Type 1 (expandable) and Type 2 (reusable)). The program aims to achieve the first flight of all 3 demonstrators by 2030, a milestone critical to validating their design and operational potential.

In the Engine Pillar, extensive ground tests will be conducted to validate the architectures and technologies of key modules, including the compressor, high-pressure core, turbine, and nozzle. These efforts will lay the foundation for the development of a flight engine demonstrator in subsequent phases. Concurrently, the system-of-systems architecture will be refined once a reference architecture is finalized in 2026. This will include advancing the Concept Selection Review (CSR) for the NGF and RCs and achieving a Preliminary Design Review (PDR) at the system-of-systems level. The PDR will mark a significant milestone by freezing interfaces and functional allocations across assets, ensuring interoperability and integration.
With its ambitious objectives and a substantial budget, Phase 2 represents a critical phase in consolidating the NGWS as a cornerstone of European defence capabilities.

Are you confident in the fact that the formal agreement between European aerospace industrial companies will be concluded in due time?

We are cautiously optimistic that a formal agreement between European aerospace industrial companies will be concluded in due time to launch Phase 2 of the NGWS program. Several factors support this confidence. For instance, the Request for Proposals (RFP) for Phase 2 has already been issued, providing nearly 18 months to reach a consensus. Additionally, the program intends to build on the many agreements already established during Phase 1B, such as those concerning intellectual property rights (IPR). These existing frameworks provide a solid foundation and ensure that we are not starting from scratch.
However, some challenges remain. Lessons learned from Phase 1B may involve changes that could create friction among partners. These adjustments are particularly critical as Phase 2 represents the last step before entering full-scale operational development, increasing the stakes regarding workshare and governance. Another significant factor is the integration of Belgium, which signed an observer Memorandum of Understanding (MoU) in June 2024 and seeks to become a full partner in Phase 2. To address this, we aim to rely first on agreements which will be forged between NGWS industrial partners and Belgian industries to ease the transition and avoid unnecessary complications.
While these challenges require careful management, the established momentum, shared commitment of all parties, and structured timeline provide a strong basis for reaching an agreement within the required timeframe.

Do you maintain regular working relations with UK and in particular the Tempest programme?

The United Kingdom has established its own cooperation framework with Japan and Italy through the GCAP (Global Combat Air Programme), with an ambitious timeline targeting an Initial Operational Capability (IOC) by 2035. Given this focused schedule, there is little room for direct collaboration on the aircraft itself between the NGWS and Tempest programs. However, opportunities for cooperation do exist in other areas, particularly in the development of certain subsystems and armaments, which are not part of the NGWS program. These areas could provide valuable synergies and enhance interoperability while allowing both programs to maintain their respective objectives and timelines.

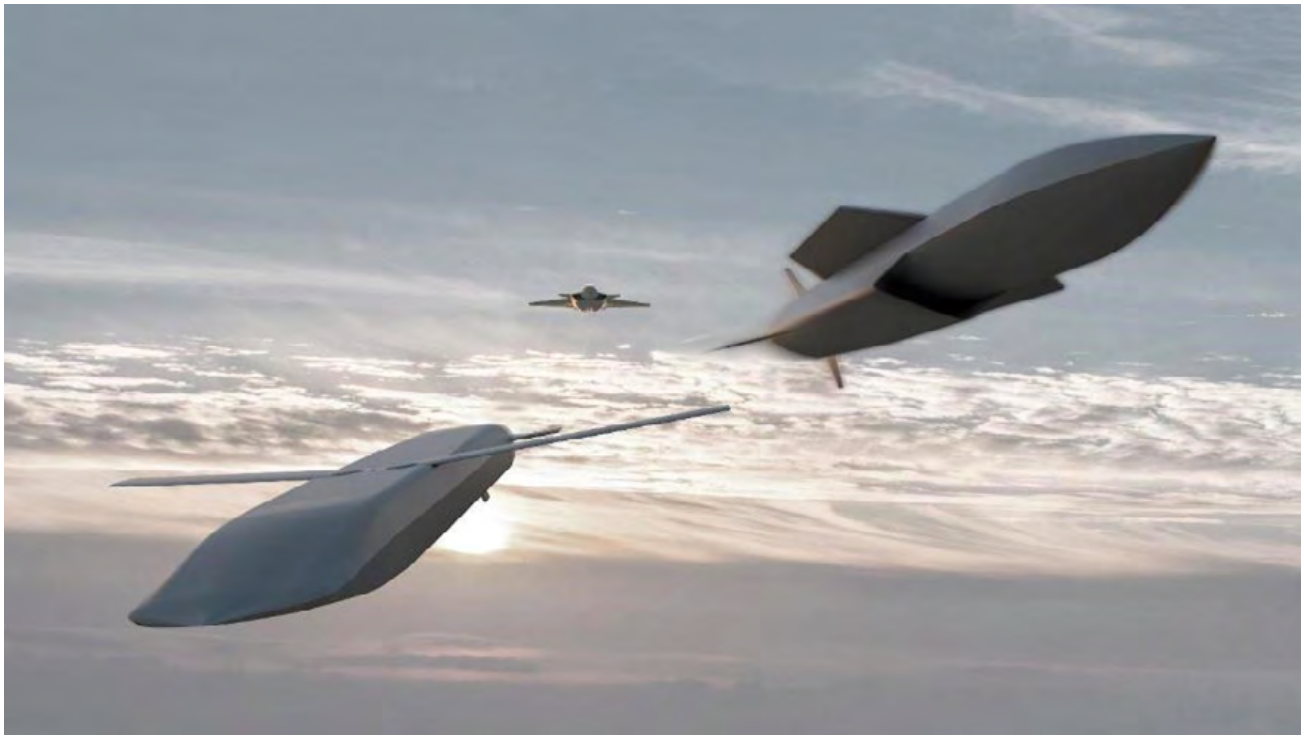
In our previous interview, you had listed some of the main challenges you were facing: on cooperation side, technology side, operational side, digital and simulation tools necessary to handle the complexity of NGWS. Could we summarize in some words how we have progressed in these four domains.

I think I have already tackled the cooperative and technology sides.
Regarding operational challenges, 2025 will indeed be a pivotal year. We will need to reach agreements with our partners on the NGWS reference architecture, which will, in turn, determine key parameters for the NGF, such as empty weight, operational range, and weapon payload capacity.
This process will provide a clearer picture of the partners' ability to align on shared requirements and transcend purely national interests. In essence, it will serve as a true stress test for the cooperative framework. Success here will not only define the technical path forward but also solidify the foundation of trust and collaboration necessary for the program's long-term viability.

What are your three priorities in the months to come?

My Three Priorities in the Coming Months:

- Completing the CSR for the Remote Carriers Pillar: One of the key milestones for the NGWS program in the coming



months is the Concept Selection Review (CSR) for the Remote Carriers pillar. This step will confirm the technical and operational choices for this essential unmanned component of the system. Essential because RC are expected as force multipliers and as a way to bring mass at lower cost around the fighter. Our focus will be on ensuring a balanced and constructive dialogue among partners to validate a shared vision that addresses operational needs while respecting the program's broader objectives.

- Preparing for the Launch of Phase 2: The transition to Phase 2 of the NGWS program is a strategic priority. We aim to establish a solid foundation for negotiations by promoting clarity, efficiency, and alignment across all stakeholders. This phase is crucial to maintaining the program's momentum, meeting shared objectives, and ensuring its long-term success. Particular attention will be paid to preserving collaborative dynamics and building on the progress already achieved during Phase 1B.
- Advancing the MGCS Program: The MGCS (Main Ground Combat System) program, which will define the future of European main battle tanks, is a cornerstone of Franco-German cooperation in defense. It serves as the second political and strategic pillar alongside NGWS, with both programs being closely interconnected. The success of one is deeply tied to the progress of the other, reflecting their shared importance in strengthening European strategic autonomy. As the MGCS program approaches a critical milestone with its first 4-year contract scheduled for the second half of 2025, we are committed to ensuring that both programs advance in a coordinated and complementary manner.

ARTIFICIAL INTELLIGENCE: CURRENT STATE, DEVELOPMENT, CHALLENGES AND RISKS

By Claude Roche, former Vice-President of the Academy of Air and Space, Paris

The official start of Artificial Intelligence (AI) goes back to the Dartmouth Conference (US) in 1956, with Marvin Minsky,
John McCarthy and Claude Shannon, where the expression was first coined, at a time when computers were becoming more widespread.
At the outset, researchers' concerns were focused on machine learning, with game theory being applied, in particular, to chess, theorem proving, operational research, image processing, recognition of pictorial patterns and speech. Simultaneously, computing power was increasing considerably, and in 1997 the Deep Blue computer beat the world chess champion,
G. Kasparov.
Since then, pattern recognition and symbolic AI have continued to merge and AI has taken off. Intellectuals, businesses and the media swear only by AI, predicting that in just a few decades, the machine will surpass man!

WHAT IS A PATTERN OR A CONCEPT?

Patterns and concepts exist when there are facts that are not purely random and that relationships therefore exist with other patterns or concepts. The patterns and concepts then constitute an immense Russian nesting doll structure, the lowest level of which is the output of optical, acoustic or other sensors and show- ing total continuity for patterns, concepts, ideas, theories, etc. The whole provides a representation of the world outside man, a living being or a machine.

PATTERN RECOGNITION AND SYMBOLIC AI

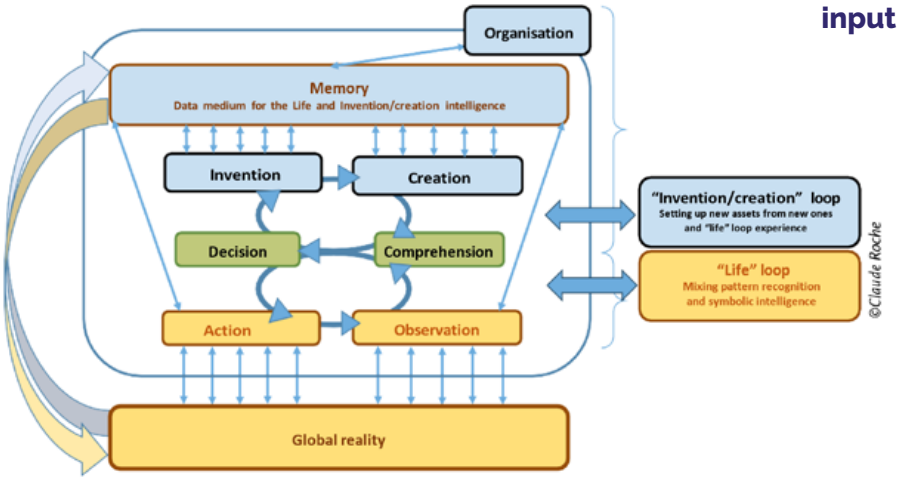
- Pattern recognition studies the detection and description of patterns or concepts by machines to satisfy different societal or industrial needs.
- Symbolic AI studies how to solve problems based on these patterns or concepts, giving rise to particular programming difficulties.

Pattern recognition can be/is used in most symbolic systems as a means to choose between the "good choice" or the "bad choice" of patterns compared to the others. These systems or methods are nowadays called "hybrid AI".

The functions of human intelligence: bijection between reality and memory

The aim of the two intelligences is to combine to obtain the best possible bijection between reality as humans apprehend it and the content of their memory, by allowing them to influence both. The medium for these functions is memory.
In the medium term, AI will only partially cover "life" intelligence (self-driving cars, household robots, security systems) and not "in- vention/creation" intelligence, except when this partially touches on intuition through deep learning.

"Current AI developments are still mainly human-driven, with only a marginal and complementary input from machine learning."
©Claude Roche



THE STRICT DEFINITION OF AI

When the computer must make decisions alone and activates a life loop and when
1. the solution is defined entirely by a logical model: this is pro- gramming.
2. the problem cannot be solved by a rigorous solution or the computer cannot apply it fast enough, but it is desirable to find a solution acceptable in practice: this is artificial intelligence.

While programming produces model errors and bugs, AI, in addition to bugs, always has a probability of error due to the absence of a rigorous model: GPS, voice and facial recognition, etc.

THE CREATION OF AI, THE LOGIC OF DEVELOPMENT

To create artificial intelligence, developers must, based on their intuition and knowledge of the problem, search, randomly or by deduction, for functions that can be assembled in multiple ways and evaluate these assemblies on a set of "learning data" repre- sentative of the phenomenon, and above all, repeat the process many times over. Finally, they must validate the result on other representative data and, if the performances are satisfactory, vali- date the resulting system in operation.

Today, there are numerous development experiences in extremely diverse fields, numerous ideas for methods and tools, such as those linked to big data and clouds, probability and correlation calcula- tions with the use of statistics, graph paths with minimax, branch and bound, game theory, image and sound processing, deep learn- ing, and all models with adequate processing power such as 2D, 3D, 4D, syntax and semantics for speaking and reading, etc.
The most important tool remains the intelligence of the indi- vidual researcher-developer who assembles all these bricks, on the principle of "trial and error" or "test and learn". Indeed, current AI developments are still mainly human-driven, with only a marginal and complementary input from machine learn- ing. And they only involve the "life loop" functions, and not yet by any means the symbolic intelligence of the "invention/ creation" loops.
Let us note in passing that this "trial and error" principle is also the basis of evolution: of the cosmos, the Earth, humanity and deep learning! And even, according to Stephen Hawking, of the Big Bang itself! Calling this "Darwinism" being English.

AI DEVELOPMENT ISSUES

1. Basic risks due to the insufficient quality of developments

- The goals of the constructed system may not have been suffi- ciently well defined: either they are not complete, or the system might find itself in a situation where two goals are contradic- tory, like the "psychological" problem of the HAL machine from "2001: A Space Odyssey".
- Training and testing data might not be representative of impor- tant exceptional situations.
- All AI systems have a non-zero error rate. Human beings have exactly the same faults!

2. Societal risks of developed systems

- Civil aviation requires a level of reliability that AI cannot possibly attain.
- Before the car accident, should the AI decide to kill other road users or the family in the car?
- What about autonomous military robots, when, according to the code of war, we have no right to seek to kill if we are not sure of our target?
- We demand perfection from a robot that we cannot prosecute in court.

All sensitive systems will take a lot of time and adaptation before they can be used, unlike other systems such as face recognition, language understanding, etc.

3. Man-machine interfaces

- Operational relationships between man and machine will have to adapt, in the same way that human pilots adapt to autopilots.
- Man-machine interfaces are not yet perfectly resolved. By in- troducing a third player, how will the system cope with three times as many interfaces?
- A huge number of simulations and time-consuming experi- ments will be necessary, with intense and multiple reflections.

Research to be carried out before unleashing strong AI

Strong AI will be a much bigger step than the one which has led to our current AI.

- Its memory will be many orders of magnitude greater
- It will learn to learn and test its efficiency for certification.
- It will invent and create, with the "invention/creation" loop that current AI does not have.

Also, it will have the ability of consciousness of its world and its

- own actions as well as of language (understanding and speaking). Getting there will take many decades of research, going much further than deep learning.
- It will be necessary in particular to teach the machine to discover a new pattern or concept, by detecting in the observed universe that something is out of the ordinary and triggering a search to define what it is by symbolic representation. We will also use the recursion of operators: the methods for discovering patterns and concepts will themselves be based on concepts, which can be discovered using the same method.
- It is then, and only then, that we will be able to imagine AI systems approaching human intelligence, whose functioning we will be able to formally represent and certify, whereas today even deep learning creates systems whose rigorous decision-making we cannot understand. We will thus have taught computers to learn intuition and rationality, both referred to as "spirits" by Blaise Pascal: the spirit of geometry and the spirit of finesse.

Claude Roche/Gérard Sabah: Intuition et rationalité – Leur symbiose chez l'humain et la machine, Les impliqués, 2023

REVIEW OF THE 58TH 3AF INTERNATIONAL CONFERENCE ON APPLIED AERODYNAMICS

By Eric Chaput (President of the 3AF Aerodynamics Technical Committee)

The 58th 3AF International Conference on Applied Aerodynamics (AERO2024) was held from March 27 to 29 in Orléans, hosted by Polytech Orléans, the polytechnic engineering school of Orléans.

In the welcome address, Régine Weber, Director of Polytech, introduced the university of Orléans and highlighted the multidisciplinary training offered to Polytech engineers, especially in the fields of energy, aerospace, and propulsion. The opening ceremony continued with a speech by Mr. Azeddine Kourta, Director of the PRISME Research Laboratory and President of 3AF's Groupe Régional Centre, who was the conference host.

Conference Chairman Mr. Eric Chaput then introduced the 3AF Association and the Aerodynamics Technical Committee, which has been organizing the annual applied aerodynamics conference for the past 60 years.

This year's theme was dedicated to "Emerging Approaches in Aerodynamics", particularly those arising from large-scale date utilization, whether derived from high-fidelity numerical simulations, advanced wind tunnel testing or innovative flight test measurements. Data-driven modelling, machine learning and artificial intelligence were among the cutting-edge topics presented by the speakers.
Ninety-seven participants from eleven countries, including France, the UK, the USA, Canada, Germany, Austria, Holland, India, Switzerland, Turkey and Pakistan, were attending the three days of presentations. The majority were researchers from university laboratories or from research institutes, alongside of thirty representatives from industry and one government agency: Airbus, Boeing, Dassault, MBDA, Rolls-Royce, Safran, Turkish Aerospace, DGA.

PROGRAMME

The conference proceeded as planned, featuring five plenary lectures and eleven scientific sessions with fifty-six papers presented.
The first plenary lecture was delivered by Mr. Olivier Marquet from ONERA, on "Data Assimilation and Stability Analysis of Turbulent Mean-Flows." This served as an introduction to the sessions on Innovative Experimental Techniques and Multiphysics Coupling. Mr. Gianluca Iaccarino, Director of the ICME Institute at Stanford University, presented "AutoEncoders for Aerodynamics - Machine Learning Predictions with Confidence Intervals," followed by sessions on Mesh Adaptation, High-Speed Flows, and Optimization with Reduced Order Models. Mr. Laurent Cordier from Institut P' - ISAE-ENSMA, discussed "Flow Control in Aerodynamics - From Model-Based to Data-Driven," leading into the sessions on Flow Control, and Exergy and Drag Decomposition. Mr. Xavier Bertrand of Airbus Commercial Aircraft, presented on "Deep Generative Models in Aircraft Aerodynamics at Airbus," followed by sessions on Real-Time Data and Unsteady Flows. Ms. Paola Cinnella from Sorbonne University's Institut Jean-Le-Rond-d'Alembert, discussed "Machine-Learning-Assisted Turbulence Modelling," introducing sessions on Machine Learning for Simulation, and Turbulent Flows and Aerodynamic Design.
Two companies, EVO Mesure and PCB Piezotronics, specializing in measurement instrumentation, particularly for wind tunnel testing, exhibited their products with demonstrations that were much appreciated by participants throughout the conference.

Conference participants at 3AF-AERO2024 - Photo Credit: Cédric Raibaudo

Orléans city hall welcome cocktail at Hôtel Groslot
Photo Credit: Cédric Raibaudo

Excellent local logistics were ensured by our colleagues from Polytech Orléans—Mr. Azeddine Kourta, Mr. Nicolas Mazellier, and Mr. Cédric Raibaudo—in support of the 3AF team on site, led by Mr. Michel Assouline and Ms. Aude Lurbe. The conference was held in a delightful atmosphere, with ample opportunities for exchange and discussion during coffee breaks and on-site lunches.

In addition to its rich scientific program, the conference offered a variety of convivial events. The traditional welcome cocktail, hosted by Orléans City Hall, took place in the prestigious Hôtel Groslot, under the auspices of Mr. Michel Assouline, General Manager of 3AF, and Mr. Azeddine Kourta, President of 3AF's Groupe Régional Centre. Mr. Florent Montillot, First Deputy Mayor of Orléans in charge of relations with the University, gave a remarkable speech. He paid tribute to Orléans City Council's commitment to research into the decarbonization of transport and emphasized the historical significance of the site, recalling that the Hôtel Groslot had welcomed the Kings of France and Joan of Arc.

The gala dinner took place at the Château de Meung-sur-Loire, preceded by a tour of the château, which was much appreciated by participants. During the gala dinner, the Jean Délery Prize for the best paper at the 57th 3AF Applied Aerodynamics 2023 Conference was awarded to Carmen Riveiro-Moreno of ONERA for her paper on "Interaction of Shock Waves with a Compliant Wall."

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Ms. Riveiro-Moreno receives Jean Délery Prize for best paper at AERO2023 conference
Photo Credit: Cédric Raibaudo

TECHNICAL VISITS

The conference concluded with technical tours that were highly appreciated by many participants.

Ms Viviana Lago, Head of Test Facilities at CNRS ICARE laboratory, showcased the PHEDRA non-equilibrium plasma wind tunnel, the MARHY hypersonic rarefied adaptable Mach wind tunnel, and the EDITH wind tunnel for the study of hypersonic interactions and transfers. Mr Pierre-Yves Passaggia from PRISME laboratory introduced the S1 subsonic wind tunnel, the Lucien Malavard wind tunnel for studying flows in road transport, aeronautics, and renewable energies, and facilities dedicated to studying hydrogen and ammonia combustion.

AERO2024 conference was a great success, our gratitude goes to Polytech Orléans for their support and hospitality, to the session chairs, speakers, participants, and to the staff of the PRISME and ICARE laboratories.

The 59th 3AF International Conference on Applied Aerodynamics, AERO2025, will focus on Unsteady Flows recent developments and applications and will be held in Strasbourg from March 24 to 26, 2025.

THE 4TH INTERNATIONAL CONFERENCE ON HIHGT-SPEED VEHICLE SCIENCE & TECHNOLOGY

The 4th HiSST Conference will be hosted by the 3AF (French Aeronautics and Aerospace Society) under the aegis of the CEAS (Council of European Aerospace Societies), in Tours, France from September 22 to 26, 2025.
As with previous editions of HiSST, HiSST2025 will be the perfect event to share work with peers and develop open and fruitful interactions with specialists from research institutions, academia and industry worldwide, covering all aspects of high-speed aerial and space vehicles development from fundamental research to final products.
Leading specialists from academia, research centers and industrial companies will provide a global view of worldwide R&D effort in the field of high-speed flight. Internationally recognized experts will give several key notes lectures addressing specific challenges and major topics in the field.
Numerous parallel technical sessions will allow to discover the latest results obtained worldwide. Focused technical workshops on high-speed vehicle science and technology will allow to share ideas with peers and develop some common activities in a collaborative forum.
All activities will take place on a single floor of the Tours conference center (technical sessions, posters sessions, technical exhibition, coffee breaks and lunches) providing a vibrant networking environment.
Finally, technical visits (some of them subject to clearance) will showcase French capabilities in the field.
Tours is a historical and beautiful city located on the Loire River, and its numerous famous castles, and provides a very pleasant, enjoyable and refreshing opportunity for friendly and fruitful exchanges, and to experience the gentle way of life "a la francaise".

The organisers look forward to welcoming all participants to the 4th HiSST Conference in Tours, France.

For more information, visit
https://www.3af-hisst2025.com

• Dr Adam Siebenhaar, Chair of International Technical Committee (Mach 7H Consulting)
• Francois Falempin, Local Host of HiSST2025 (3AF – former MBDA)

CONFERENCE TOPICS

High-Speed Missions and Vehicles including:
- Planned and ongoing national and international high-speed vehicle programs and missions
- Advanced space launcher concepts and high-speed atmospheric flight vehicle concepts
- Design, development and manufacturing of related technologies and components, both for reusable and expendable applications
- Design methodologies and engineering models
- Overall system design and/or performance optimization

Propulsion Systems and Components including rocket, ramjet, dual mode ramjet, scramjet, rocket and turbine combined cycles, detonation engines, electric propulsion and other advanced propulsion systems addressing:
- Advanced cycles & concepts
- System & component performance, development & manufacturing: air inlets, isolators, combustors, injectors, ignition, flame-holding, nozzles…
- Combustion and mixing processes including ignition, flame-out, instabilities, plasma assistance…
- Airframe interaction and integration
- Conventional, cryogenic & alternative fuels, additives, catalysis
- Fuel systems: feed lines, pumps, tanks…
- Advanced computational techniques, CFD & engineering models

Thermal, Energy and Management Systems for vehicle, subsystems, and payload, including sources, conversion and distribution systems addressing:
- Thermal protection, heat exchangers, cooling, coating & ablative systems
- Active and Passive systems
- System & component performance, development & manufacturing
- On-board power generation and environmental control
- Design methodologies, CFD & engineering models and advanced computational techniques (multi-physics)

Guidance & Control Systems including flight mechanics, guidance, navigation, routing, trajectory optimization, operations research, sensors, actuators, controllers

and algorithms, and health monitoring addressing:
- Flight control design and in-flight adaptation
- On-ground and in-flight trajectory optimization techniques
- Health monitoring and management, fault detection isolation and recovery, health and usage monitoring systems
- System & component performance, development & manufacturing
- Advanced computational techniques, CFD & engineering models

Materials and Structures for vehicle and all subsystems covering:
- Metallic & non-metallic materials for hot and cooled structures and thermal protection systems
- Active/functional materials
- Hot, cold and integrated structural architectures including conformal layouts
- Quality control, damage tolerance, structural health monitoring and survivability
- Materials manufacturing and processing
- Advanced modelling & computational techniques

High-Speed Aerodynamics and Aerothermodynamics with application to hypersonic regimes covering full Mach range from take-off, cruise and (re)-entry including:
- Numerical and experimental studies including aerothermodynamics, stability-transition-turbulence, SWBLI, MHD, gas physics and chemistry, radiation physics, fluid structure interaction and destructive re-entry
- Numerical and experimental thermal studies incl. passive and active heat transfer, regenerative, transpiration, ablation, pyrolysis, endothermic decomposition…
- Advanced modelling & computational techniques: development and validation
- Multi-disciplinary techniques and models: fluid-structure interaction, conjugate heat transfer, CFD/flexible and rigid body dynamics

Testing & Evaluation covering:
- Ground and in-flight test facilities, flight test operations and simulations
- Diagnostics and data systems
- Scale limitations and facility effects
- Validation and verification
- Facility modelling & simulation

Operation and Environment including:
- Economic and market analysis including cost modelling
- Regulatory, certification, operation, maintenance, health & safety issues: on-ground and in-flight
- Environmental effects including sonic boom, noise and emissions
- Atmospheric composition – models and effects on performance
- Infrastructure and traffic management

Hypersonic Fundamentals and History including
- aero-thermodynamics, stability-transition-turbulence, SWBLI, MHD, gas physics and chemistry, radiation physics, fluid-structure interaction and destructive re-entry
- Theoretical and analytical thermal studies incl. passive and active heat transfer, regenerative, transpiration, ablation, endothermic decomposition…
- Basic materials science for high temperature and aggressive environment, life-time predictions…
- Historical aspects, analyses and assessments and lessons learned
- Educational initiatives and workforce development activities

TECHNICAL VISITS

Last conference day will be dedicated to technical tours.
- Technical tours to MBDA facilities (ramjet test facility and composite fuel-cooled structures manufacturing plant) as well as to CNRS-ICARE facilities will be also proposed (clearance required). Registration is mandatory: deadline is fixed on 30 June 2025.
- Movies will be presented to all attendees (ONERA wind tunnels, CEA MegaJoule Laser facility)

10TH CEAS AEROSPACE EUROPE CONFERENCE 28TH AIDAA CONFERENCE 10TH AEROSPACE & DEFENSE MEETING

> CEAS AEC / AIDAA 2025

The **Italian Association of Aeronautics and Astronautics** (AIDAA) and the **Council of European Aerospace Societies** (CEAS) are delighted to announce a joint event for the 28th AIDAA International Congress and the 10th CEAS Aerospace Europe Conference. T**his prestigious conference will take place in Turin, Italy, from December 1 to 4, 2025.**

The joint event aims to establish a dynamic forum for collaboration and knowledge exchange among renowned scientists, researchers, industry stakeholders, and policymakers. By bridging the gap between academia, research institutions, and industry, the conference seeks to:

- Foster the exchange of ideas and cutting-edge research.
- Identify emerging trends and technologies.
- Discuss pathways to develop solutions that address critical challenges in aerospace.
- Promote synergies and partnerships to drive innovation and technological advancement.

This event offers an opportunity to inspire the aerospace community and outline a strategic vision for the sector's future.

The joint conference will be held at the **Centro Congressi Lingotto**. The venue, inaugurated in 1994, is a testament to the transformation of the former FIAT factory into a multifunctional center designed by the acclaimed architect Renzo Piano. The venue boasts impressive facilities, including:

- **Meeting Rooms:** Accommodating up to 3,500 seats and spanning 24,000 square meters in total.
- **Two Auditoriums:** The Auditorium "Giovanni Agnelli," a masterpiece of architecture with 1,900 seats, and the smaller "Room 500" with 476 seats.
- **Registration and Cloakrooms:** Convenient desks for registration and cloakroom services.
- **Exhibition Areas and Catering Spaces:** Up to 2,700 square meters of space close to the meeting rooms, perfect for exhibitions and catering.

Given its proximity to the Oval Lingotto, the AIDAA and CEAS conference will be closely connected with the **Aerospace & Defense Meetings (A&DM) Torino** (Aerospace & Defense Meetings Torino). Over the past eight editions, A&DM Torino has established itself as the premier international event for the aerospace and defense industry. During the three-day event, participating companies will have the opportunity to meet, build targeted business relationships, and develop new projects with partners from around the world. A&DM Torino, with more than **100 international exhibitors**, brings together the entire supply chain and all its key players through an innovative matchmaking program, exploring the key challenges and opportunities shaping the future of aerospace.

In addition to the conference activities, attendees can participate in technical tours at leading aerospace com-

Aerospace & Defence Meetings, Turin 2021

Centro Congressi Lingotto

Mole Antonelliana

panies and institutions such as Thales Alenia Space, Leonardo S.p.A, Avio Aero, Altec (Aerospace Logistics Technology Engineering Company), and the Astronomical Observatory. Moreover, tourist tours will be organized to give attendees a chance to discover Turin's beauties, such as **the Mole Antonelliana and National Cinema Museum, the Egyptian Museum, Piazza Castello and Palazzo Madama, the Venaria Reale** (UNESCO World Heritage site), **the Basilica di Superga**, and **the Automobile Museum of Turin**.

For more information, please visit our website at Ceasaidaa2025 - AIDAA or contact us via email at CEASAIDAA_conference@aidaa.it.

COMPARISON OF STANDARDS AND GUIDELINES IN USE IN THE DIFFERENT IAQG SECTORS

By Alfio Mantineo , ESA – Head of OPS PA&S office Member of EAQG/IAQG Space Forum and AIMM core team

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Dr. Andre LaCroix, ArianeGroup – Quality Performance – Norms and Standards Chair of EAQG /IAQG Space Forum

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Speaking with colleagues and quality professionals, standards always occupy a prominent role. If not the most important topic of discussion. Outside this group, however, the topics "standards" and "guidelines" usually show up in two contexts that seem not correlated but that, indeed, are strictly linked:

- **"Do we have a standard or a guideline for that?"**
- **"Why do we need to address so many standards?"**

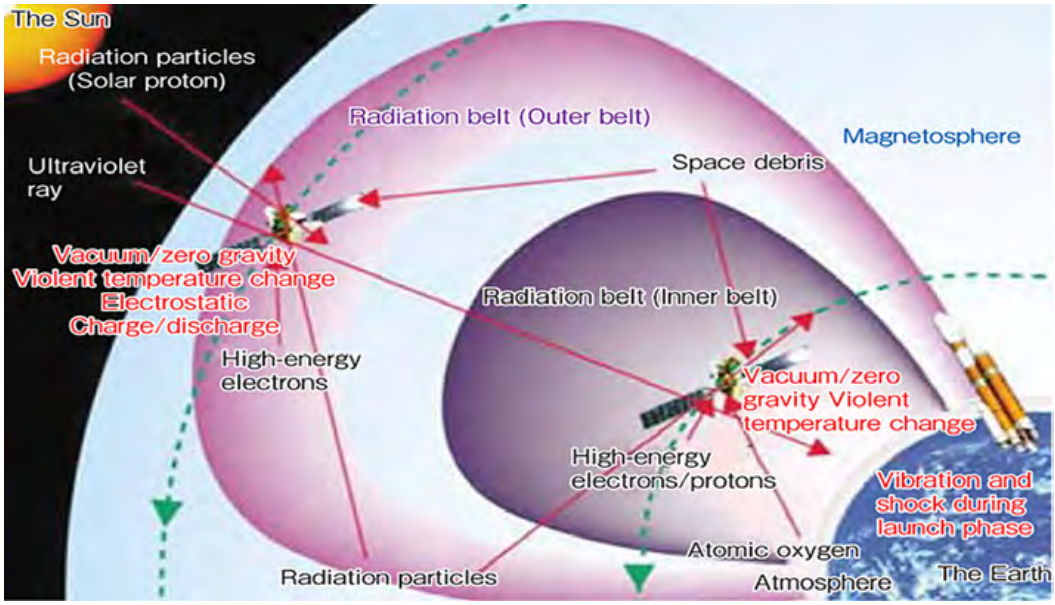
Standards and guidelines, in a strongly codified environment like aerospace, are very pervasive to convey knowledge, align expectations, and mitigate risk to ensure On Quality Delivery, On Time Delivery and On Cost throughout the entire value stream. As for the electricity in our home, their absence is noted, not their availability.

Knowledge preservation and transfer are, without doubt, an extremely important aspect; however, it is in the dimension of contract execution that the aspects of "compliance" and the issue of "statement of compliance" become key drivers due to the "legal value" aspects and have been appreciated outside the pure technical/ engineering world.

The availability of standards simplifies the contract definition as an aggregate macro that implies several requirements with a single line. For the entire supply chain, this would be a massive simplification for the processes to be implemented and the deliverable to be provided as evidence records. Unfortunately, these simplifications will be voided if the customer refers to different standards (from different sources) that would overlap (with partial duplication of requirements) or, even worse, conflict on the processes' phases and deliverables to be produced.
The utilization of standards doesn't just add simplification within the contract requirements, it is also a tool for negotiating and tailoring the technical and managerial requirements between the supplier and customer and for gaining shared expectations concerning the requirements settings.
Sometimes, more than one standard can be used for the same specific domain, and in such cases, the different stakeholders must carry out off-line comparisons between the "applicable standards" to choose the most appropriate one in terms of various considerations such as affordability, simplicity, availability of resources and more. Therefore, it is vital to carry out comparison studies to make standards utilization more convenient for the supplier and the customer.

The space industry and its customers have long leveraged design and manufacturing assurance processes developed in the second half of the twentieth century to develop, deliver, and use highly complex and critical systems that must work on demand.
Technical standards have been developed to provide design and assurance controls to address the unique environments and stresses. Design for space applications does recognize that real-time troubleshooting, maintenance, and repair will be highly constrained or nonexistent. Awareness of the design and use conditions unique to the space environment, e.g., severe thermal stresses, vacuum conditions, and high radiation levels, is essential to ensure quality management systems are augmented with appropriate controls, both custom-designed and leveraged from existing technical standards. The importance of standards utilization is increased when considering the safety of having people in space or on the moon surface. This implied challenging requirements far above those of aviation.

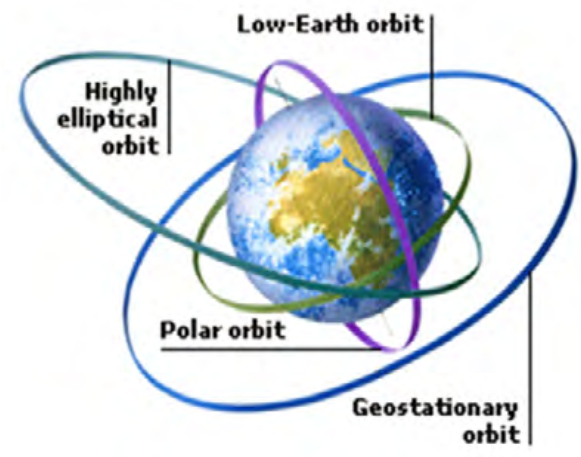
Initially, the "only" customers were governments who regulated the space industry based on their needs (military, weather forecast, communication and so on). The



long and complex programmes to be implemented by the national agencies required codifying these "new specific requirements" and "qualified processes" to simplify contract definition and management, extending the same approach taken so far in the defence sector. The extension of the interest for commercial utilization of space and civil spacecraft applications in recent decades led commercial entities to join governments as customers.

In Europe, space programmes involved different countries from the beginning, and the requirement for common standards was immediately perceived as a strong need. From its creation, the European Space Agency (ESA) was the driver in the definition of space requirements and standards. The first initiative was the system of "ESA Procedures, Specifications, and Standards (PSS)" produced until 1994. Their importance, not only for the "customer layer" but for the entire supply chain members, led to the establishment of the "European Cooperation for Space Standardization (ECSS)," an initiative established to develop a coherent, single set of user-friendly standards for use in all European space activities [www.ecss.nl].

As of today, more than 130 ECSS standards cover the branches of Engineering, Management, Product Assurance, and Sustainability. In addition, there are over 50 handbooks and 300 templates (document requirements definitions – DRDs) to support the production of the deliverables as requested in the standards.
Following the recommendation from the European Space Forum, the ECSS Steering Board decided in 2023 to create a new "I-branch" in the ECSS system to cover "Industrialization, Production and Maintenance, Repair and overhaul" The foreseen I-branch documentation will include a coherent set of core requirements/means of compliance based on standards already used in the aerospace sectors (e.g. IAQG) through adoption notices to allow consistency with the other ECSS branches and adaptation to space specificities. The ECSS-I-branch particularly addresses space programmes and the users dealing with the mass and serial production of space systems and products (such as for constellations).
Along with the European Space Standards Initiative, a major contribution was made by the US National Aeronautics and Space Administration (NASA) and the Japan Aerospace Exploration Agency (JAXA) in order to build their own standards and supporting documentation system.
The participation of ESA and the other European National Agencies in international space programmes like the International Space Station (ISS) showed the complexity of standards applicability when procurement and production of different sub-systems were entrusted to suppliers and partners being only familiar to the specific standards used by NASA, ESA or JAXA. As it is not suitable to apply all of these standards, mutual recognition between the agencies was pursued. This was one of the key activities of the Safety and Mission Assurance (S&MA) Trilateral Working Group constituted by NASA, JAXA, and ESA meeting periodically over the last decades to exchange technical information of mutual interest and to foster cooperation in the space S&MA field among the participants. This assessment aimed to compare practices, tools, and standards that have been performed over the years, leading to the identification of commonalities and differences used to recommend standards for evolution. Those results were used to simplify the definition of requirements for the contractual activities of the multinational programmes of interest.
In this respect, the SM&A Trilateral Working Group comparison and mutual recognition were just the anticipation of the same need for space industries with a base of customers and suppliers beyond national and European borders, as already well known in aviation and defence.
An interesting and highly meaningful domain for compa-

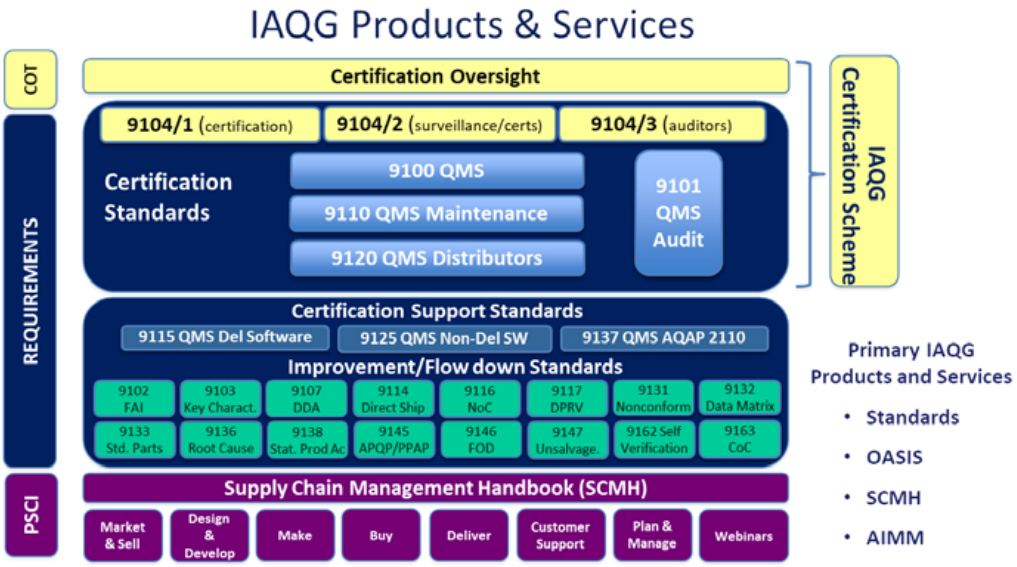


ring the three standardization systems is their approach towards Quality Assurance (QA), or as it is termed in the space industry - Product Assurance (PA). The evolution of common practices for Quality Management Systems (QMS) within the aerospace industry, as expressed in IAQG 9100, triggered the interest to find out if such an agreed framework is reflected identically or at least similarly in the three agencies' system of standards.
Within the IAQG, the Space Forum, comprising of selected experts from major space organizations, continuously explores and promotes the utilization of IAQG 9100 for space applications.
In comparing the main three standardization systems used in the space industry (ECSS, JAXA and NASA), differences can be seen in all scopes of quality assurance topics of interest. However, the general outline and the operation concept are similar to those expressed in IAQG 9100.
Significant variations are present when dealing with technical requirements relating, for example, to the impact of the space environment and mitigation techniques, production quality, and reliability. However, all the standardization systems refer to more general topics within their requirements, such as QMS establishment and maintenance, customer satisfaction, and documented information.

The construction of a QMS, which is oriented towards space design and production, is a key challenge common to the space industry (commercial and governmental) and their customers (commercial customers, space agencies and governments). In building such a system, one must integrate the structured requirements of IAQG 9100 and the more specific requirements that are stated in space standards for quality assurance programmes (e.g., ECSS-Q-ST-20, JAXA-JMR-13, NASA-NPR-8735.2C). The effort to compare the requirements of these standards is one of the objectives in the current work of improving the Space Application guidance established by the Space Forum in the IAQG Supply Chain Management Handbook (SCMH).
The International Aerospace Quality Group (IAQG) was established in December 1998 as an initiative of Airbus (Airbus, Casa, Eurocopter), Boeing, BAe Systems (British Aerospace), Dassault, GE Aviation, IHI, Northrop-Grumman, Rolls-Royce and Safran (Intertechnique, Snecma) to create common supplier requirements and to effectively deploy the quality standards created by IAQG members throughout the entire aerospace supply chain.

As part of IAQG, the Space Forum was created in 2002 to identify the needs of the space industry and institutional customers and leverage opportunities, engaging stakeholders to share concerns and lessons learned in efforts to strengthen the Space Industry.
In the frame of the IAQG Ecosystem, the IAQG "Supply Chain Management Handbook" (SCMH) provides guidance materials intended to assist organizations with understanding IAQG requirements and how to apply them. Its objective is to help the supply chain improve their quality performance through a better understanding of aviation, space, and defence industry quality management system requirements and expectations".
In this context, the IAQG - Space Forum sought the need to better enable IAQG customers' understanding of unique considerations in space hardware design, production and quality assurance as compared to the aviation sector, which currently constitutes the majority of IAQG members' business.

The commonalities are supply chain complexity, design margins, qualification / certification and technical leveraging, and the common interests of system developers in solving technical issues that affect the material, part, and system availability. Those challenges are coming from emerging technologies and regulatory changes. In all cases, they have a very high socio-economic impact.
The Space Environment Challenges span from extensive acoustic noise and vibrations during take-off to the vacuum effects, radiation, and manned environmental issues.
Product characteristics represent challenges for the supply chain in terms of high reliability in the absence of opportunity for repair. This cascades on the need for robust manufacturing producers associated with small production volume. The smaller market as compared to aviation, requires the need for requalification of material not specifically developed for space, which creates additional challenges to be managed.
In this context, the guidance, aimed at pointing the different Space Applications to the relevant processes to be applied in a Quality Management System, is based on IAQG 9100 (e.g., for ionizing radiation, the impacted design process would be the definition and selection of appropriate components and materials, proof of design, simulation, qualification life cycle tests).
The impact of extreme Ionizing Radiation on space products mainly concerns electronic components such as Electrical, Electronic, and Electromechanical (EEE)



devices. Industry is more and more using IPC standards instead of ECSS for commercial space (constellations, launchers). But for expensive or safety-critical missions, hardened components are definitely essential.

Standards are a major source of information in developing sustainable industrial processes, policies and requirements agreed by producers and customers regarding COTS selection and qualification components for space use, particularly the topic of radiation hardness. Refining the requirements becomes even more complicated when considering the various attributes of a specific space mission and the components used, such as its criticality, complexity, duration and budget. The various space standards set many requirements to protect space products from damage due to ionizing radiation; however the space community still doesn't hold a common approach toward this field.

This technical example encourages comparison studies between standards for making common ground for industry development and effectively utilizing IAQG 9100 for QMS development within the space industry.

Even more important is the fact that similarly to IAQG 9100, which augments ISO 9001 requirements, existing space-specific norms in the European, Asia-Pacific, and Americas sectors further augment the requirements for space application – Japan example: the quality assurance programme standard JMR013 from the Japan Aerospace Exploration Agency (JAXA) Safety and Mission Assurance Department is based on IAQG 9100 requirements. It contains additional requirements for quality assurance activities, which are considered indispensable for mission success of launch vehicle and spacecraft contracts.

Interest in the guidance triggered some further improvement and expansion of documents. Since space is still a smaller market than aviation, even small and medium enterprises are exposed to standards generated in different countries and continents.

The Space Forum's current focus is to issue an improved version of the SCMH guidance document by adding links between key space requirements (from NASA, JAXA, ECSS) and some of the contents of IAQG 91xx standards and SCMH guidance material

At the same time, all the specific space "challenges" identified will be indicated in the list of key guidelines from Space (ECSS, NASA, JAXA…), addressing each of them to allow more understanding of there implications and expectations as well as the constraints and risks to be considered.

A further area of improvement targets small and medium enterprises' knowledge transfer. Similarly, for the ECSS DRD, some product assurance plan template(s) for space products will be provided based on examples from the three sectors of IAQG.

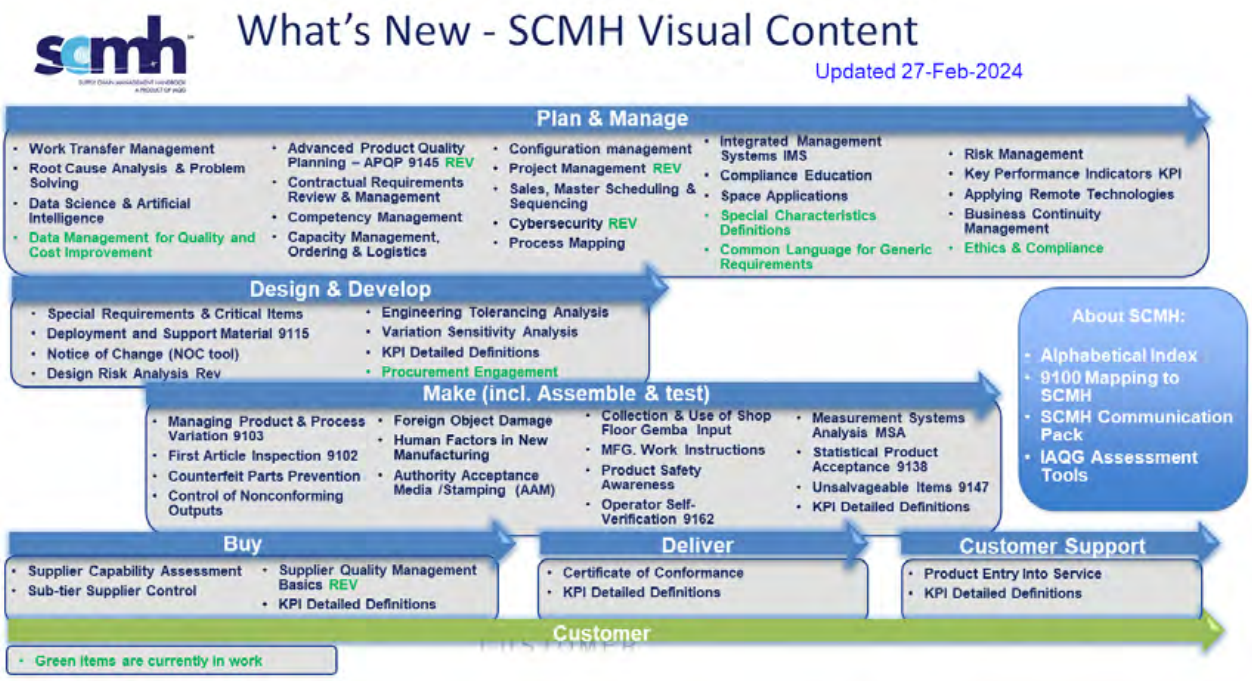
The availability of the exercise conducted by the Trilateral Working Group for the mutual recognition of standards and processes has been seen as extremely valuable input for starting this new activity. During the last ESA-JAXA-NASA Trilateral meeting in Frascati (ESRIN-27-28 June 2024), the board agreed to provide the "ESA-NASA-JAXA Trilateral Task Force on Mutual Recognition of Standards" to IAQG.

The Aerospace Improvement Maturity Model (AIMM) provides a good example for the evaluation process of company's adoption and implementation of standards, in this case IAQG 9100 within their specific areas of interests. In addition, it helps improve beyond compliance with the IAQG 9100 standard toward optimization and demonstrated business excellence.

By using AIMM, an organization can evaluate its current level of maturity and set clear targets for improvement. This online application supports the performance of self-assessments against the model, which can be planned

and tailored following the users' needs. An AIMM assessment can cover either the entire scope of the IAQG 9100 standard or specific areas of interest.
AIMM is linked with SCMH elements to understand the possible way of ensuring compliance with the requirements of IAQG 9100 and the expected outcomes. One planned evolution of AIMM is the possibility of creating an "overlay" that allows the restriction of the focus on specific areas. So, instead of seeing all best practices relevant to the full domain of IAQG 9100 complaints in terms of aviation, space, and defence, the scope could be restricted, simplifying the use of the tool.
The initial use of the overlay is to expand the current possibility of adding notes specific to the organization and would allow to integrate company-specific elements of the management system (embedded in the existing 26 different modules). An even more interesting possibility would be to make an overlay specific to "Space Applications," providing the user with a relevant set of best practices and recommendations for the "Space" domain. An updated SCMH module could be the catalyst for that.
This article reviews ongoing work by the IAQG Space Forum to improve guidance on using standards within the aerospace industry that emphasize special space environments and engineering considerations. A major outcome of this work is identifying the need to compare various standards and their requirements to align expectations between customers and producers in terms of both contractual relationships and engineering best practices.
It is found that the comparison of standards and guidelines in use in the different IAQG sectors (Europe, Americas, and Asia Pacific) is a way to provide additional support for European Small and Medium Enterprises (SMEs)in the global aerospace market

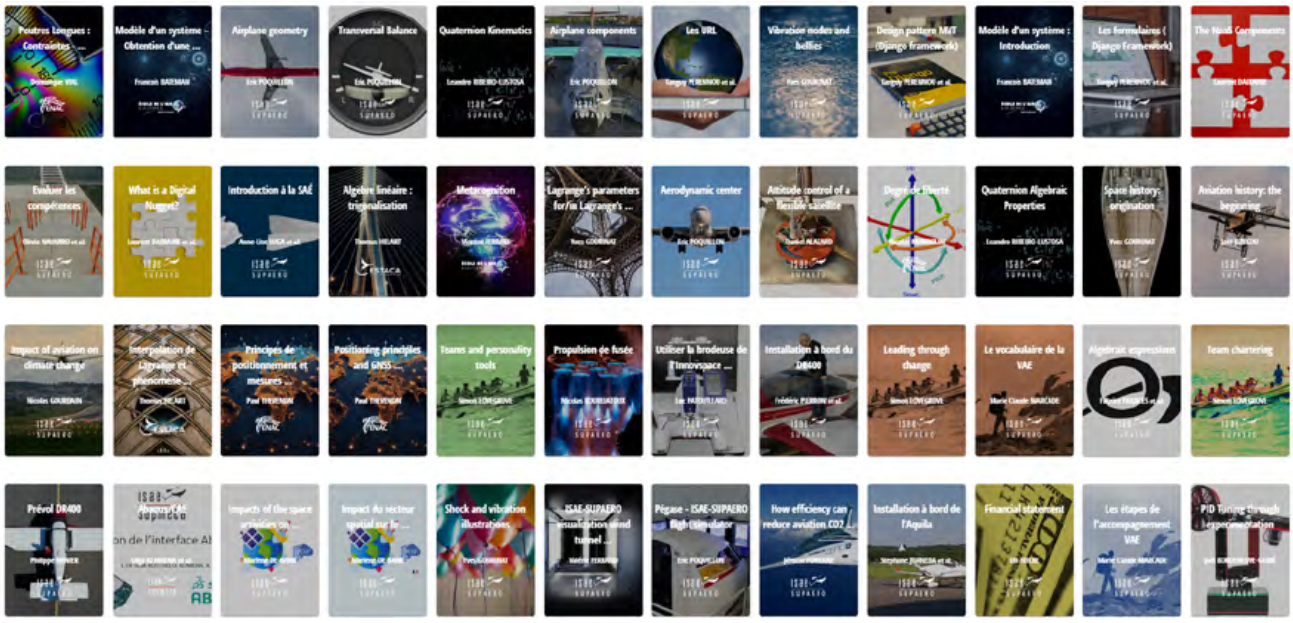
This exercise is an invitation to further unify standards by identifying commonalities and differences without replicating what already exists. Standard commonality will also increase efficiency, avoiding duplication and repetition.
This not only impacts IAQG activities but is also a contribution to the ECCS review, which is currently ongoing.



References:
ECSS - European Cooperation for Space Standardization https://ecss.nl/
IAQG - International Aerospace Quality Group https://www.iaqg.org/
AIMM - Aerospace Improvement Maturity Model https://aimm.iaqg.org/
SCMH - Supply Chain Management Handbook https://iaqg.org/tools/scmh/

VIRTUAL LABS IN AEROSPACE ENGINEERING EDUCATION

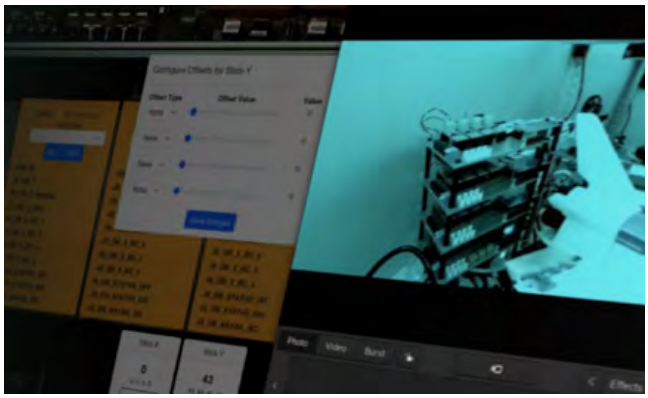
HELD DURING THE PEGASUS NETWORK SPRING MEETING 2024, A SYMPOSIUM ON AEROSPACE EDUCATION PUTS THE FOCUS ON VIRTUAL AND REMOTE LAB EXPERIENCES



A recent symposium on aerospace engineering education, hosted by Universitat Politècnica de Catalunya (UPC) and organized by the PEGASUS network of aerospace Universities, brought together leading experts and educators to explore the transformative potential of virtual and remote labs. The symposium highlighted the challenges and advantages of implementing these innovative learning tools, enabling new Master's programs, inclusive access to education, and opportunities across frontiers.

While practical lab sessions are regarded as a crucial tool for students to apply their knowledge and gain invaluable practical experience, remote labs offer a valuable alternative, providing students with applied experience while overcoming geographical and logistical barriers.
Especially critical during crisis such as the recent COVID pandemic, flash floods that leave entire regions isolated, etc., remote labs' usefulness doesn't end with these tragic circumstances. As aerospace engineering curricula continue to evolve, the need for innovative educational tools that facilitate shared or remote degrees or enable students' access to unique facilities brings the focus on remote labs.
The symposium was introduced by Joan Gispets, vice-rector of UPC for Academic Policy, highlighting UPC's Learning Galaxy project, an ambitious initiative aimed at transforming the learning experience for students. The project focuses on three main goals: 1) improving student training in terms of knowledge, abilities, and competencies; 2) enhancing the learning experience to make university sessions unique and engaging; 3) boosting the academic indicators of the university. Learning Galaxy leverages innovative and disruptive educational technologies to offer personalized learning experiences, adapting quickly to the needs of students and educators.

HYBRID MODELS – IN SITU AND REMOTE



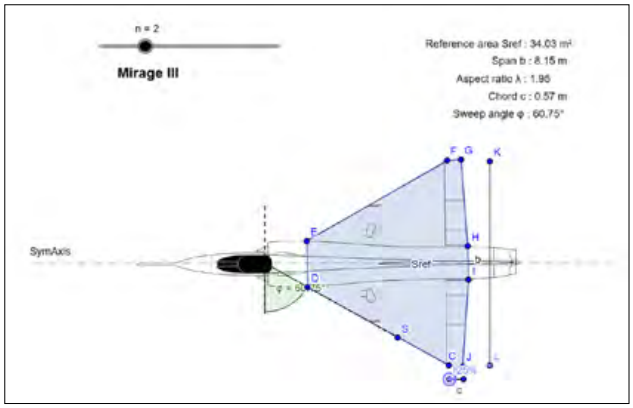
Opening the floor -connecting remotely to the lab, of course-, Bastian Lüttig from Stuttgart University showcased a HYMASY, a hybrid laboratory designed for teaching embedded systems development and redundant avionics computers. This lab combines both in-situ and remote approaches, combining physical hardware that can be accessed by the students with remote access capabilities, allowing students to develop and test on actual hardware from anywhere.
Dr. Lüttig emphasized the importance of hands-on experience with real systems, even if they are development

boards, in understanding system failures and redundancy mechanisms. The hybrid lab setup includes debugging tools, network devices, and redundant systems, providing a comprehensive learning environment for aerospace engineering students. This approach ensures that students gain practical skills that are directly applicable to real-world failure scenarios.

BEYOND SPECIFIC REMOTE LABS – THE IREAL FRAMEWORK

Laurent Dairaine from ISAE-SUPAERO demonstrated how this approach can be taken beyond an individual, specific remote lab. The IREAL framework is a set of scalable and robust web-based tools that allows building a high number of remote labs. The platform allows students to conduct real-world experiments remotely, using pre-recorded data and multimedia content.

The idea is that a parametric study is conducted and recorded in-situ. Then, the framework's components allow the students, through a standard web browser, to choose the parameters they want to test and "run" the experiment virtually, observing not only the pre-recorded video of what happens with the parameters they selected, but also hearing the sound, watching data plots, and even downloading the raw data specific to their parameters.
Prof. Dairaine highlighted the platform's ability to provide realistic and interactive learning experiences, making it accessible and affordable for a large number of students simultaneously, since the experience is pre-recorded and no live equipment is needed. Examples of experiments included vibration studies, automatic control systems, propeller noise, heat exchangers, and even a whole turbofan test run, demonstrating the platform's versatility across various fields.



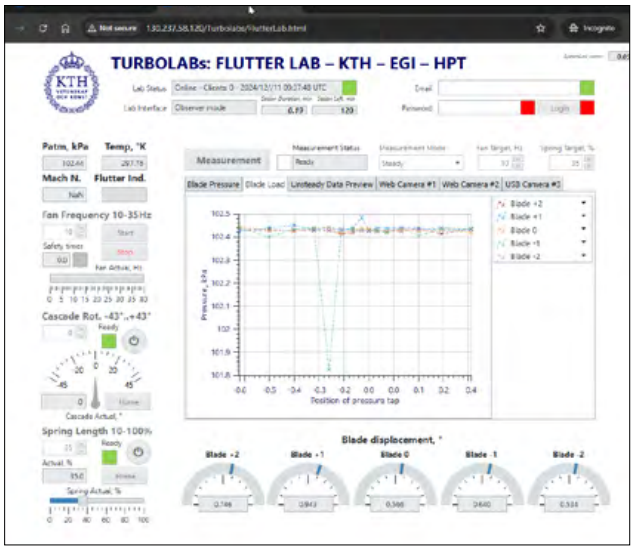
DIGITAL NUGGETS OF KNOWLEDGE

Another proposal of ISAE-SUPAERO is the so-called "aerospace digital nuggets". These are short, focused educational tools designed to enhance aerospace education on a single specific topic. The nuggets are less than 30 minutes long and, crucially, are decontextualized to facilitate easy integration into various learning management systems (LMS). This promotes the students' curiosity and allows them to easily allocate their learning in their own time.
The platform emphasizes the importance of interactive and multimedia content, which includes videos, clickable images, text, and practical exercises at the end of the nuggets to check that the learning objectives have been reached. The MLEARN platform also supports learning analytics, providing valuable feedback to educators and students. By offering high-quality, reusable content, MLEARN aims to make aerospace education more accessible and engaging, enabling innovative curricular pathways and self-paced learning.

FULLY REMOTE, REAL TIME TURBOMACHINERY LAB

In contrast with pre-recorded experiments, and similarly to the HYMASY proposal, Prof. Jens Fridh from KTH presented an innovative, fully remote lab experience focused on turbomachinery. This lab provides students with actual, real-time control of the experiment. A technician on site will prepare and activate the test bench, and the students are then able to start and stop it, and also select some of the parameters of the experiment remotely through a web interface.

Live video of the lab is provided along with real-time data readings. Safety measures are in place to automatically terminate the measuring session if unsafe parameters or conditions are detected. Different configurations are allowed, allowing the students to explore the behaviour of turbomachinery cascades, blade flutter phenomena, etc.



The remote lab is also used in courses for industry and as a learning platform for PhD students, showcasing its versatility and effectiveness.

INNOVATIVE MASTER'S DEGREES

These kinds of remote labs are not only useful in cases of emergency – rather, they also provide a medium to design innovative educative experiences. Two examples of the new kind of Master's degrees that are enhanced by these technologies were presented at the symposium.

First, Prof. Benigno Lázaro from Universidad Politécnica de Madrid (UPM) presented the online Master's Degree in Numerical Simulation in Engineering. This program, conducted in collaboration with ANSYS, offers specializations in solid mechanics and fluid mechanics. Prof. Lázaro highlighted the program's structure, which includes basic and advanced modules, and the flexibility it offers to accommodate students' varying schedules. The use of forums for interaction and the emphasis on practical applications through simulation tools were key points of discussion. Virtual classrooms, implemented through an LMS, combine theory chapters, application chapters, videos, homework, tutorials, etc. to provide an immersive learning environment.

Going beyond the barriers of a single University, Prof. Fernando Varas from UPM presented a joint program organized by five universities, the Master's Degree in Industrial Mathematics. This program addresses the growing integration of mathematics in engineering, offering a blend of professional and research-oriented education. The program's structure includes core training in differential equations, programming, and numerical methods, as well as specialization modules in mathematical modelling and numerical simulation. The importance of industry partnerships and real-world problem-solving was also emphasized. Remote learning technologies enable the students of this Master that are attending at one of the Universities to follow and participate in real-time lessons that are being imparted in the other Universities, thus benefitting from a highly specialized curricula that draws from the strengths of each participant institution.

LOOKING AHEAD

The symposium underscored the very diverse ecosystem of available remote lab tools and the diverse approaches to integrating remote labs into aerospace engineering education. From digital nuggets and online master programs to virtual and hybrid labs, these tools offer significant benefits, including increased accessibility, flexibility, and practical experience. However, challenges remain, such as ensuring the quality and reliability of remote experiments, addressing the diverse backgrounds of students, and fostering effective interaction in a virtual environment. Looking ahead, the focus will be on refining these tools, expanding industry partnerships, and leveraging advanced technologies like artificial intelligence and machine learning to further enhance the educational experience. As remote labs continue to evolve, they hold the promise of transforming aerospace engineering education, making it more inclusive, interactive, and aligned with the demands of an ever-changing, fast-pacing world. As institutions continue to collaborate and innovate, the future of aerospace engineering education looks promising, with remote labs playing a pivotal role in shaping the engineers of tomorrow.

Jorge García Tíscar
On behalf of PEGASUS network

OUTLINE OF THE LATEST ISSUES OF THE CEAS SPACE JOURNAL AND THE CEAS AERONAUTICAL JOURNAL

The journals were created under the umbrella of the Council of European Aerospace Societies (CEAS) to provide an appropriate platform for excellent scientific publications submitted by scientists and engineers. The German Aerospace Centre (DLR) and the European Space Agency (ESA) support the Journals, which are published by Springer Nature.

The **CEAS Space Journal** is devoted to excellent new developments and results in all areas of space-related science and technology, including important spin-off capabilities and applications as well as ground-based support systems and manufacturing advancements.

The **CEAS Aeronautical Journal** is devoted to publishing new developments and outstanding results in all areas of aeronautics-related science and technology, including design and manufacturing of aircraft, rotorcraft, and unmanned aerial vehicles.

Both journals play an increasingly important role in representing European knowledge in aerospace research. Nevertheless, the biggest challenge is still to attract an acceptable number of high caliber scientists and engineers to submit articles for publication. Therefore, we invite you and your colleagues to contribute to the development of these journals by publishing your hard-earned results.

Papers which are considered suitable will be subjected to a comprehensive blind peer-review process for potential publication in the CEAS Journals.

A list of articles published in the latest issues of both CEAS Journals is attached.

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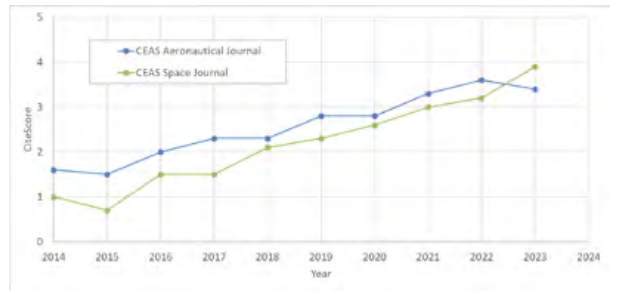

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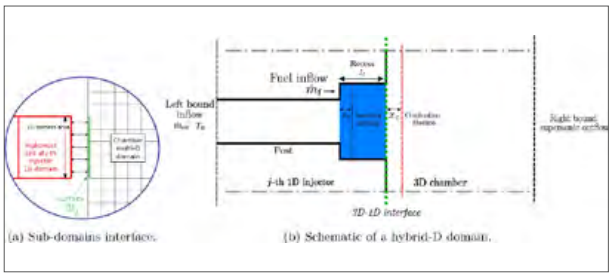
CEAS SPACE JOURNAL

Volume 16, Issue 6, November 2024

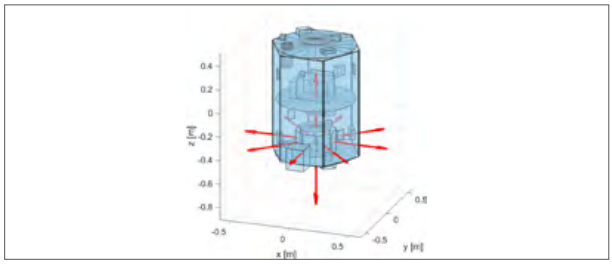
LOW-ORDER MODELING APPROACH FOR THE PREDICTION OF TRANSVERSE COMBUSTION INSTABILITIES IN MULTI-INJECTOR ENGINES

Paolo Maria Zolla, Alessandro Montanari, Simone D'Alessandro, Marco Pizzarelli, Francesco Nasuti, Rocco Carmine Pellegrini & Enrico Cavallini / Published online: 11 March 2024 (Open Access)



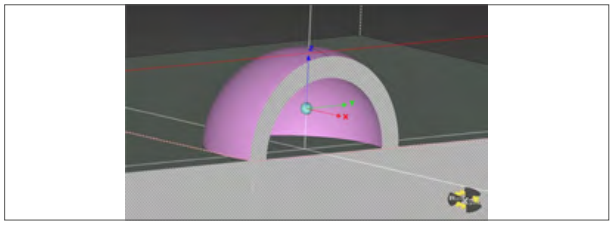
NUMERICAL SIMULATION OF COSMOS 2499 FRAGMENTATION

Lorenzo Olivieri, Cinzia Giacomuzzo & Alessandro Francesconi /Published online: 15 March 2024 (Open Access)



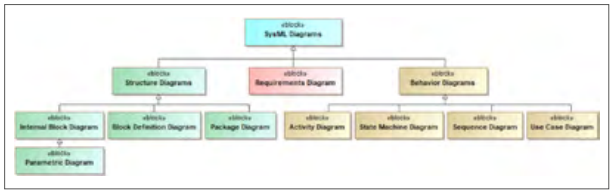
REGOLITH-BASED LUNAR HABITATS: AN ENGINEERING APPROACH TO RADIATION SHIELDING

Yulia Akisheva, Yves Gourinat, Susanna Guatelli, Cédric Dossat, Steven Robin-Chabanne, Athina Varotsou, Aidan Cowley & Advenit Makaya / Published online: 19 March 2024



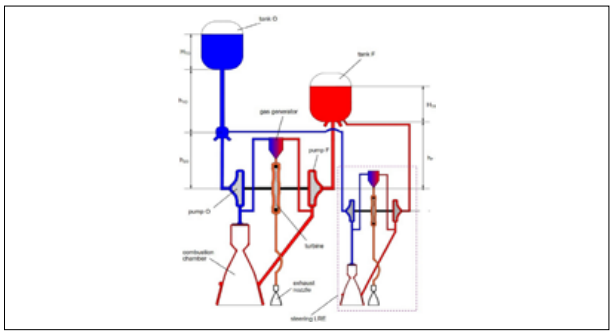
EFFECTIVE MODEL-BASED SYSTEMS ENGINEERING FRAMEWORK FOR ACADEMIC NANOSATELLITE PROJECT MANAGEMENT AND DESIGN

Ahmed Hanafi, Zakaria Moutakki, Mohamed Karim & Tajjeeddine Rachidi / Published online: 19 March 2024



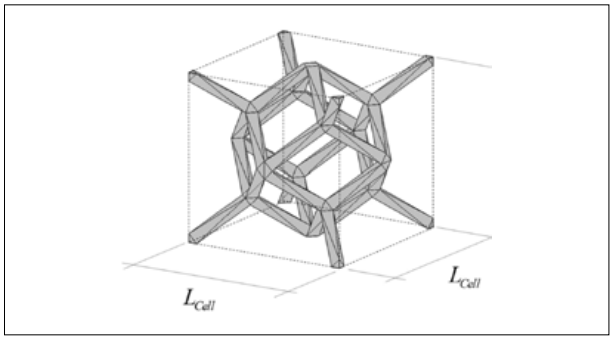
FEATURES OF MATHEMATICAL MODELING OF NONLINEAR POGO OSCILLATIONS OF LAUNCH VEHICLES

S. Dolgopolov &nO. Nikolayev / Published online: 25 March 2024



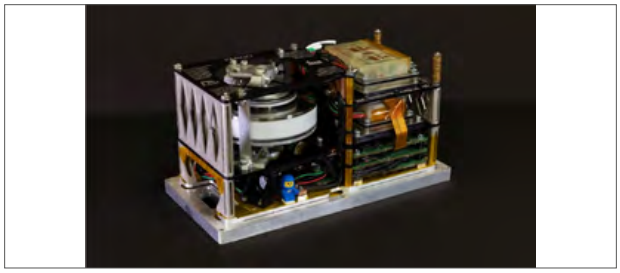
INVESTIGATIONS INTO THE MECHANICAL PROPERTIES OF TA6V DODE-THIN LATTICE SANDWICH BEAMS FABRICATED BY POWDER BED LASER BEAM MELTING PROCESS

Philippe Guy, Olivier Dorival, Marco A. Pérez, Jean-Noël Périé, Christophe Fabriès & Guilhem Michon / Published online: 27 March 2024



FARGO: VALIDATION OF SPACE-RELEVANT FERROFLUID APPLICATIONS ON THE ISS

Saskia Sütterlin, Daniel Bölke, Manfred Ehresmann, Nicolas Heinz, Janoah Dietrich, Bahar Karahan, Maximilian Kob, Michael O'Donohue, Christian Korn, Steffen Grossmann, Daniel Philipp, Michael Steinert, Denis Acker, Yolantha Remane, Phil Kreul, Maximilan Schneider, Sebastian Zajonz, Bianca Wank, Fabrizio Turco, Manuel Buchfink, Elizabeth Gutierrez, Sonja Hofmann, Silas Ruffner, Alexander Wagner, Laura Breitenbücher, Felix Schäfer, Georg Herdrich & Stefanos Fasoulas/ Published online: 30 March 2024 (Open Access)



HYBRID SUPERVISION SCHEME FOR SATELLITE ATTITUDE CONTROL WITH SENSOR FAULTS

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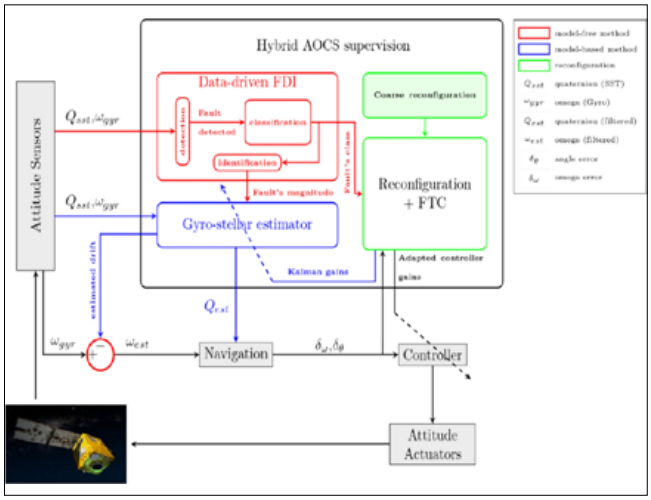

CEAS AERONAUTICAL JOURNAL

Volume 15, Issue 4, October 2024
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CHALLENGES AND OPPORTUNITIES IN POWER ELECTRONICS DESIGN FOR ALL- AND HYBRID-ELECTRIC AIRCRAFT: A QUALITATIVE REVIEW AND OUTLOOK

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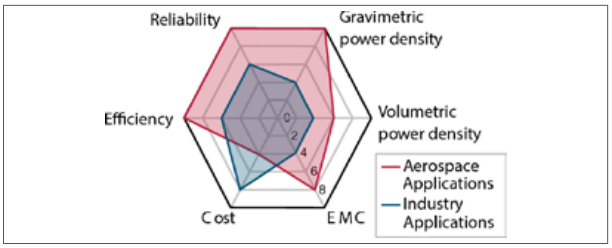

ASSESSMENT OF AN AUTO-ROUTING METHOD FOR TOPOLOGY GENERATION OF AIRCRAFT POWER SUPPLY SYSTEMS

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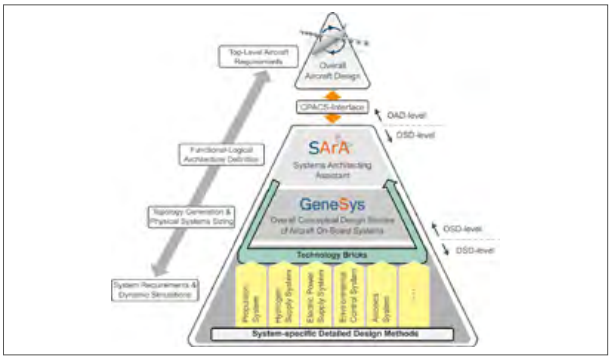

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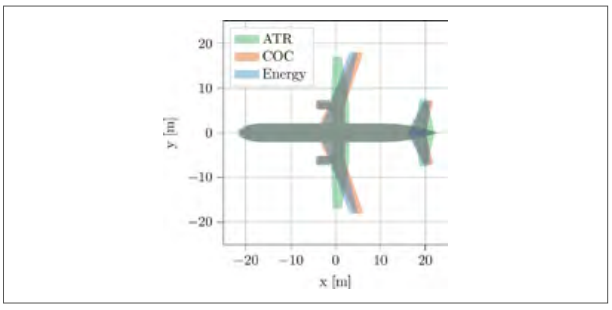

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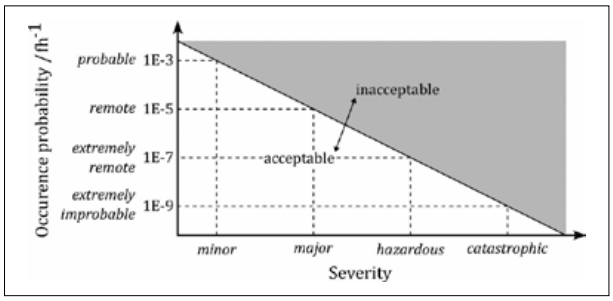

SENSITIVITY ANALYSIS OF URBAN AIR MOBILITY AIRCRAFT DESIGN AND OPERATIONS INCLUDING BATTERY CHARGING AND SWAPPING

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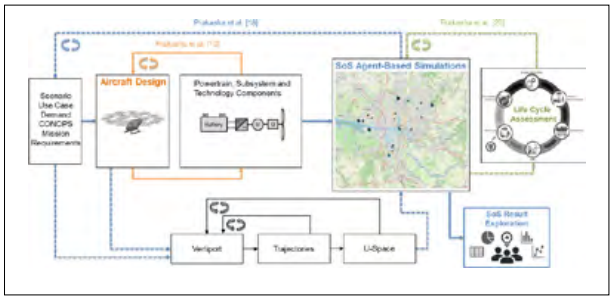

IMPROVING LOCAL PATH PLANNING FOR UAV FLIGHT IN CHALLENGING ENVIRONMENTS BY REFINING COST FUNCTION WEIGHTS

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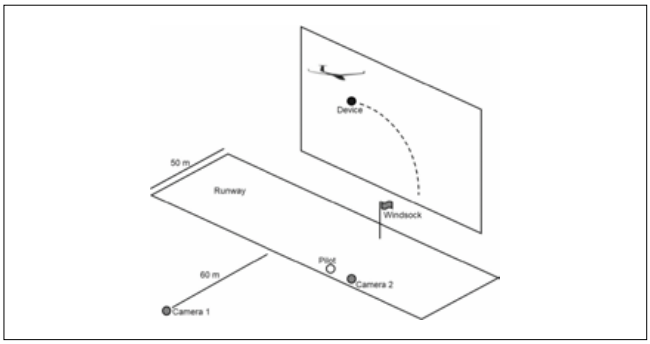

OBSTACLE ENCOUNTER PROBABILITY DEPENDENT LOCAL PATH PLANNER FOR UAV OPERATION IN URBAN ENVIRONMENTS

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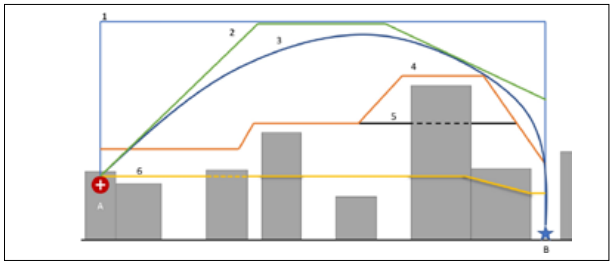

DEVELOPMENT OF AN ACOUSTIC FAULT DIAGNOSIS SYSTEM FOR UAV PROPELLER BLADES

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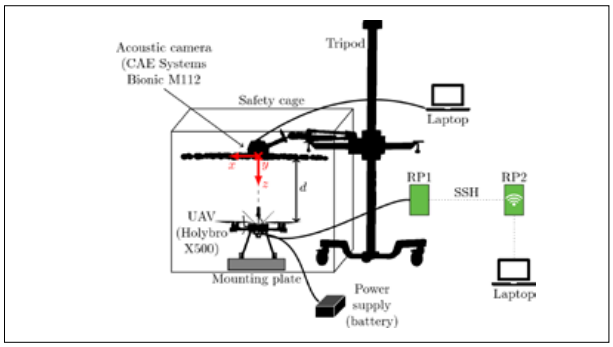

ASSESSMENT OF STRUCTURAL MECHANICAL EFFECTS RELATED TO TORSIONAL DEFORMATIONS OF PROPELLERS

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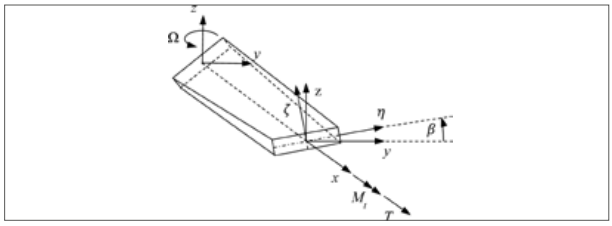

UNSTEADY NONLINEAR LIFTING LINE MODEL FOR ACTIVE GUST LOAD ALLEVIATION OF AIRPLANES

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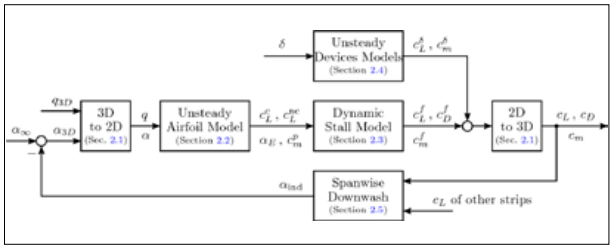

UNCERTAINTY QUANTIFICATION OF THE ONERA 7A ROTOR PERFORMANCE AND SPANWISE STRUCTURAL LOADS USING A SURROGATE-BASED APPROACH

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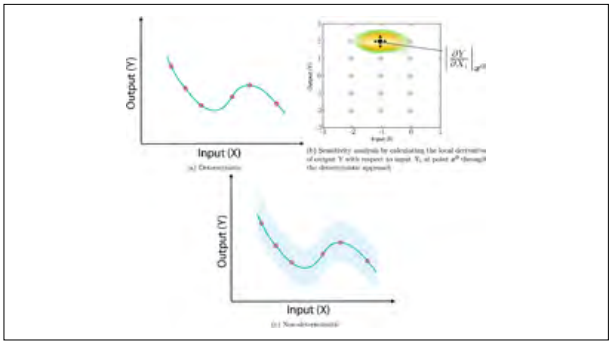

EXPERIMENTAL INVESTIGATION OF DYNAMIC GROUND BOUNDARY CONDITION FOR A NON-SLENDER DELTA WING

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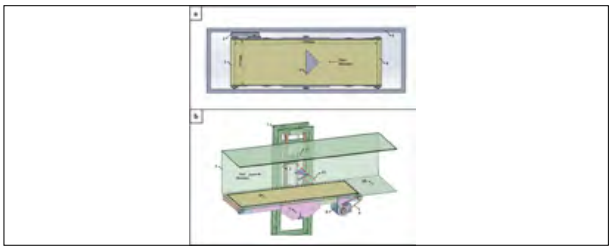

ACTIVE FLUTTER SUPPRESSION FOR LIGHT SPORT AIRCRAFT BY A CONTROL SURFACE SPLIT

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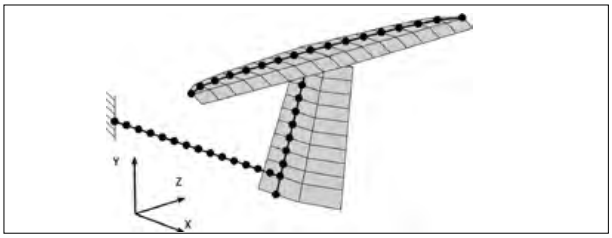

LEADING EDGE VORTEX DYNAMICS ON FINITE ASPECT RATIO SWEPT WINGS EXHIBITING LARGE AMPLITUDE OSCILLATIONS

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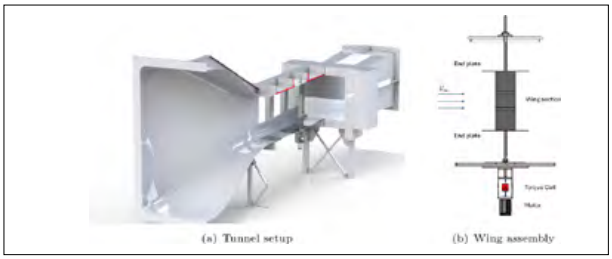

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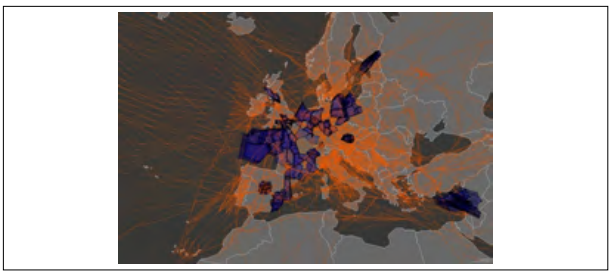

EXPERIMENTAL EVALUATION OF ALTERNATIVE CEILING-BASED VENTILATION SYSTEMS FOR LONG-RANGE PASSENGER AIRCRAFT

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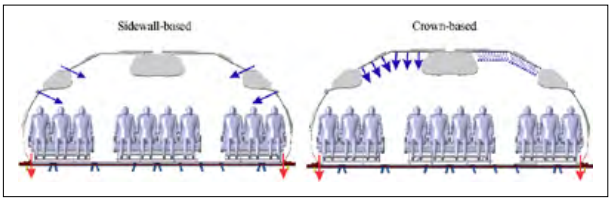

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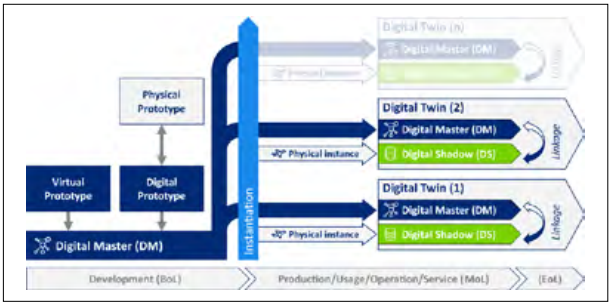

A DISCUSSION ON BENCHMARKING UNCONVENTIONAL CONFIGURATIONS WITH CONVENTIONAL AIRCRAFT: THE BOX-WING STUDY CASE

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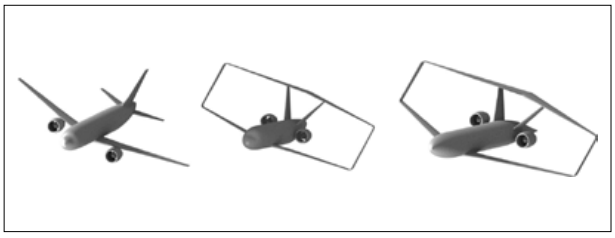

DESIGN AND ASSESSMENT OF FIGHTER PILOT ASSISTANCE SYSTEMS FOR AIR-TO-AIR REFUELLING WITH PROBE-AND-DROGUE-EQUIPMENT

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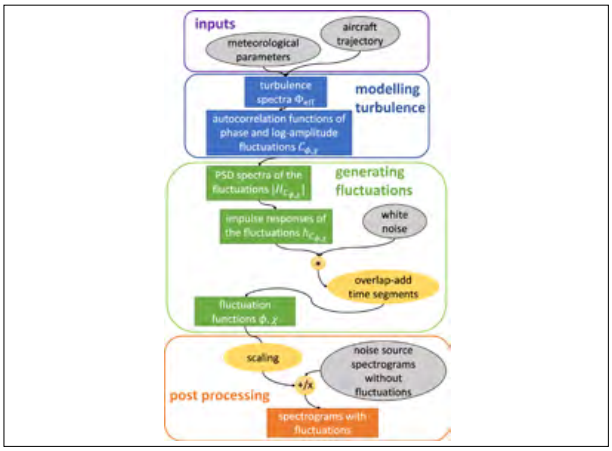

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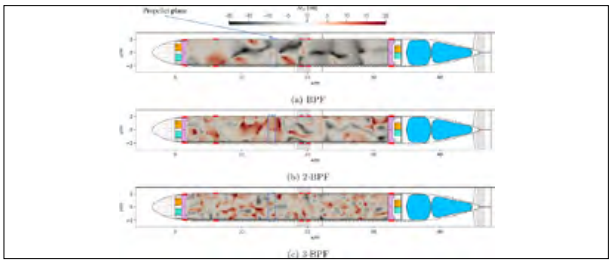

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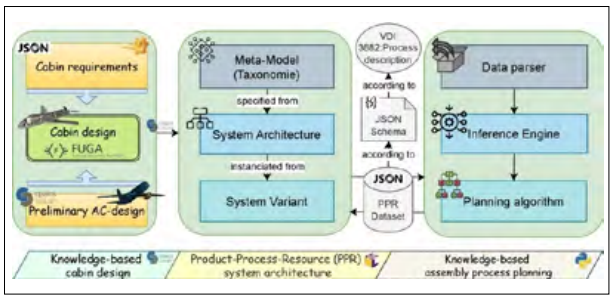

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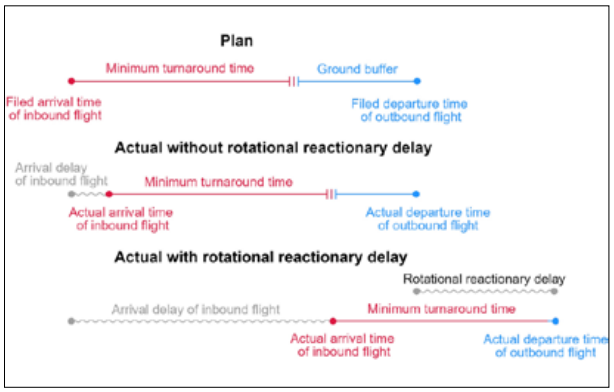

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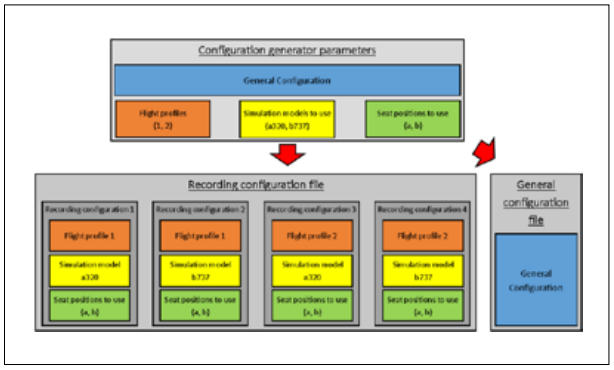

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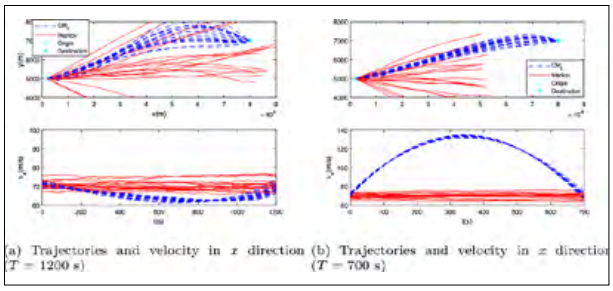

AUTOMATED PACKING AND PIPING IN AN AIRBUS A320 MAIN LANDING GEAR BAY: AN INDUSTRIAL DEVELOPMENT CASE STUDY

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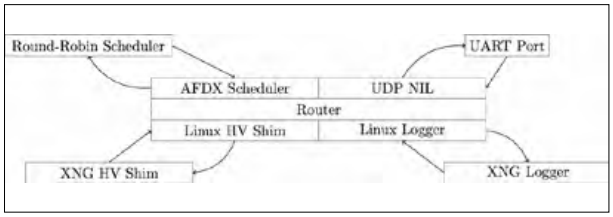

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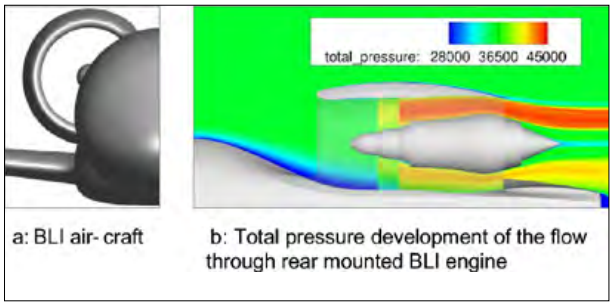

2025

AMONG UPCOMING AEROSPACE EVENTS

JANUARY

28-29 January – EC – **17th Space Conference – Meet the leaders – Shape Europe's Future** – Brussels (Belgium) – SQUARE – Meeting Centre, Pont des Arts – https://space-conference.eu

28-30 January – 3AF – **TSAS2025 – Towards Sustainable Aviation Summit** – Toulouse (France) – https://www.3af.fr/agenda

FEBRUARY

10-12 February – **ICAO Global Implementation Support Symposium 2025** – Abu Dhabi, United Arab Emirates https://www.icaogiss2025.com/

24-28 February – **Combustion Course Emphasizing Energy Transition** – at the Eindhoven University of Technology, The Netherlands https://www.ercoftac.org/events/combustion-course-emphasizing-energy-transition/

26-27 February – **Advanced Manufacturing for Aerospace & Materiel** – Mercure Bristol Grand Hotel, Bristol, United Kingdom – https://www.defenceiq.com/events-advanced-manufacturing/agenda

26-27 February– ASCENDxTexas – **Strategic Transitions – Aligning Stakeholders for Giant Leaps** – Houston, Texas, USA – https://www.ascend.events/ascendx/ascendxtexas/

MARCH

01-08 March – IEEE – **IEEE Aerospace Conference** – With AIAA and PHM Society cosponsors - To promote interdisciplinary understanding and aerospace systems - Big Sky, MT (USA) – Yellow Stone Conference Sponsors - www.ieee.org - https://www.aeroconf.org

04-05 March – **11th Annual Space Traffic Management Conference** – Austin Texas, USA – https://iaaspace.org/event/11th-space-traffic-management-conference-2025/

18-20 March – **Flight Dispatcher Days 2025** – Brussels (Belgium) https://www.eurocontrol.int/event/flight-dispatcher-days-2025

18-19 March – **Clean Aviation Annual Forum 2025** – Brussels (Belgium) https://clean-aviation.eu/media/events/clean-aviation-annual-forum-2025

19-20 March – **RAeS Flight Operations Conference 2025** – Single Pilot Operations - Logical Progression or a Step Too Far? Royal Aeronautical Society Headquarters London, UK https://www.aerosociety.com/events-calendar/

24-26 March – **59th Edition of the 3AF International Conference on Applied Aerodynamics** – Strasbourg, France – https://www.3af-aerodynamics.com/

APRIL

8 -10 April – AIAA – **25th ICNS Conference at EUROCONTROL's headquarters** in Brussels (Belgium) – https://www.eurocontrol.int/event/25th-icns-conference-in-europe

09-12 April – AIAA – **AERO Friedrichshafen,** Germany, https://www.aero-expo.com/

14-17 April – **ICAO Facilitation Conference (FALC 2025)** – Doha, Qatar - https://www.icao.int/Meetings/FALC2025/Pages/default.aspx

15-17 April – AIAA – **AIAA DEFENSE Forum – Secret/NOFORN** – Laurel, MD (USA) – www.aiaa.org/events www.aiaa.org/defense

22-24 April – III ECCOMAS – **Thematic Conference on Multidisciplinary Design Optimization of Aerospace Systems AEROBEST2025** – Lisbon, Portugal – https://aero-best.idmec.tecnico.ulisboa.pt/

MAY

04–08 May – **15th IAA Symposium on Small Satellites for Earth System Observation** – Berlin, Germany – https://iaaspace.org/event/15th-iaa-symposium-on-small-satellites-for-earth-system-observation-2025/

05-09 May – **IAA Planetary Defense Conference 2025** – Stellenbosch, Cape Town, South Africa – https://iaaspace.org/event/9th-iaa-planetary-defense-conference-2025/

07-09 May – **AERODAYS 2025** – Warsaw, Poland – https://aerodays2025.eu/

13-15 May – **CANSO** – AIRSPACE World 2025 – Bringing together the entire aviation community to define our future skies - https://airspaceworld.com

13-15 May – **3AF** – IAMD 2025 – Integrated Air and Missile Defence – Thessalonique Greece) - https://airspaceworld.com

18-22 May – **The 3rd International Conference on Flight Vehicles, Aerothermodynamics and Re-entry (FAR)** – Arcachon, France – https://atpi.eventsair.com/far2025

19-20 May – **Farnborough International Space Show** – FARNBOROUGH, UK – https://farnboroughspaceshow.com/

AMONG UPCOMING AEROSPACE EVENTS

20-22 May – **European Business Aviation Convention & Exhibition (EBACE)** – Geneva, Switzerland – https://ebace.aero/

21-22 May – **RAeS 2025 FCAS** – Summit: Redefining the Future of Air and Space Power, Royal Aeronautical Society Headquarters, London, UK – https://www.aerosociety.com/events-calendar/

22-23 May – **ERCOFTAC Spring Festival 2025** – Stockholm, Sweden – https://www.ercoftac.org/ercoftac_news/ercoftac-spring-festival-2025/

JUNE

09-11 June – **12th IAA Symposium on Future Space Exploration** –Torino, Italy– https://iaaspace.org/event/12th-iaa-symposium-on-the-future-of-space-exploration/

10-11 June – **European Test and Telemetry Conference** – Toulouse, France – https://conference-ettc.org/

15-18 June – COMPDYN 2025 – **10th International Conference on Computational Methods in Structural Dynamics and Earthquake Engineering** – Rhodes Island, Greece – https://2025.compdyn.org/

16-20 June – **Turbo Expo 2025 Renasant Convention Centre Memphis** – Tennessee – https://event.asme.org/Turbo-Expo

16-22 June – SIAE – **Paris International Air Show** – Paris-Le Bourget (France) – https://www.siae.fr

18-20 June – **ACI EUROPE Annual Congress & General Assembly 2025** – Athens, Greece – https://www.aci-europe-events.org/

22-25 June – **The Fourth International Nonlinear Dynamics Conference (NODYCON 2025)** – Hoboken, NJ, USA – https://nodycon.app.earendelplatform.com/

24-25 June – **RAeS Sustainability Conference, Royal Aeronautical Society Headquarters** – London, UK – https://www.aerosociety.com/events-calendar/

30 June - **04** July – **11th European Conference for AeroSpace Sciences (EUCASS)** – Rome, Italy https://eucass2025.eu/

JULY

07-11 July – EUROMECH – **ESMC12** – 12th European Solid Mechanics Conference – Lyon (France) – https://euromech.org/

21-25 July – AIAA – **AIAA AVIATION Forum** – Las Vegas, NV (USA) – www.aiaa.org/events

22-24 July – **ASCEND/powerd by AIAA** – Las Vegas, NV (USA) – www.aiaa.org/events

AUGUST

26–29 August – EFDC2 – **2nd European Fluid Dynamics Conference** – Dublin, Ireland – https://euromech.org/conferences/folder-efdc/EFDC2

30-31 August – **INTERNATIONAL AIR SHOW & GENERAL AVIATION EXHIBITION** – Bucharest, Romania – https://www.otopeniairshow.ro/

SEPTEMBER

9-12 September – **51st EUROPEAN ROTOCRAFT FORUM 2025** – Venice, Italy – https://www.erf2025.com/

14 - 19 September – **39th International Electric Propulsion Conference** – Exhibition Rd, South Kensington, London SW7 2AZ, UK – https://www.imperial.ac.uk/iepc2025/

16-18 September – **Eurogen 2025 Conference** – Lahti, Finland – https://www.lut.fi/en/eurogen-2025

22-26 September – 3AF/ESA – **HiSST2025** – High-Speed vehicle Science and Technology – Tours (France) – https://www.ffrägenda/

29 September - **03** October – IAF/IAC – **76th International Astronautical Congress** – Sydney (Australia) – www.iac2025.org

OCTOBER

14-17 October – **15th EASN International Conference** – Madrid, Spain https://easnconference.eu/

NOVEMBER

12-13 November – RAeS 2025 Research – **Innovation, and Tech Conference, Royal Aeronautical Society Headquarters** – London, UK https://www.aerosociety.com/events-calendar/

DECEMBER

01-04 December – CEAS – **AEC 2025** – AEC2025 – CEAS biennial Conference 2025 – Torino (Italy)

10-11 December – **15th Aviation Forum 2025** – Hamburg, Germany https://www.aviation-forum.com


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