CEAS
Council of European Aerospace Societies

# BULLETIN AEROSPACE EUROPE


*ESPADON: A FUTURE MILITARY HYPERSONIC AIRCRAFT CONCEPT*

**INTERVIEW WITH BRUNO SAINJON, PRESIDENT AND CEO OF ONERA, THE FRENCH AEROSPACE LAB**

AEROSPACE EUROPE bulletin N° 1-2024 – January-March

## 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 –*
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## 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:**
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- Medals in Technical Areas
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## 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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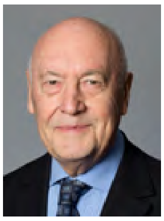
# EDITORIAL



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**Dear readers,**

I would like first to address my thanks to Bruno Sainjon, president and CEO of the French Aerospace Lab 'ONERA' for having accepted an interview with 3AF.

If I have chosen to illustrate the front page of this CEAS bulletin with the mock-up of the hypersonic aircraft "Espadon" unveiled by ONERA in last June at Le Bourget Air Show, this is because this project, conducted at DGA (French Armament Procurement Agency)'s request, evoked during the interview, is of highest importance for the future of air defence. The ONERA's mission is to establish a roadmap defining the basic technology researches to be conducted with a view to developing for such an air combat vehicle fitting to meet the requirements of the various missions defined by the Air and Space Force. The perspective to see flying "Espadon" is still faraway (2050 time horizon), but the technology bricks realised are likely to irrigate other current programmes, particularly the Future Air Combat System (FACS) programme. The long-term industrial interest is quite clear.

However our discussions were most notably devoted to civil aviation: circular economy, neutral-carbon objective, research tasks being conducted within EREA's framework, participation of ONERA in Clean Aviation JU's and SESAR JU's programmes.

Then, after a number of opinion and technical papers from Clean Sky, EREA, SESAR, and Airbus UpNext, all Sustainable Aviation oriented, the aerospace defence topic is again considered, with the AAE/DGLR Avis/Opinion "Collaborative Air and Space Combat Operations" recently edited and whose Executive Summary is herein reproduced.

In parallel with the Sustainable Aviation challenge, "How to clean Space?" is another worrying top priority, actively dealt with by ESA, as presented in the paper "The new ESA space debris mitigation policy".

For Ariane 6, 2024 will be the decisive year, its inaugural flight being expected to take place between 15 June and 31 July.

As regards Starship, a short debriefing of its second flight test of 18 November is herein presented. The third one is announced for next February.

Concerning Education and Training, the new SESAR Digital Academy is presented, which provides opportunities for students to contribute to the development of future ATM.

In his message, CEAS president Franco Bernelli informs us of the different events and initiatives of our association in 2024, which again demonstrates the vitality of our association.

Please receive Dear readers, my warm regards and best wishes for this New Year 2024!

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# CEAS PRESIDENT'S MESSAGE

*Franco Bernelli Zazzera*
*CEAS President 2021-2024*

The CEAS Board of Trustees just confirmed me as President for the year 2024, for a fourth term. I must thank the CEAS community for their trust and I feel a great responsibility for this role during 2024.
As the year starts, CEAS welcomes officially the Von Karman Institute as new corporate member, opening its membership to the Belgian community and one of the most relevant research institutes in Europe. The worldwide recognition of the institute in some research topics will be important and of great help in organizing the future AIAA/CEAS Aeroacoustics events.

The aerospace sector is particularly lively and active, and as usual this issue of the bulletin proposes some extremely interesting highlights from this community, with long-term perspectives that will project us directly into the second half of this century.
In a more time-limited perspective, the year 2024 will be very particular for the CEAS community because of a large number of events, the most important being all held in Italy. This was also one of the motivations behind confirming an Italian presidency for CEAS.
The impressive list of events, supported by the corresponding CEAS Technical Committees, starts with the 3rd International Conference on High-Speed Vehicle Science and Technology (HiSST), to be held on 14-19 April in Busan, South Korea. At the end of the abstract selection process, more than 310 abstracts have been accepted and it looks that the event recovered well and has caught up with the pre-covid numbers.
Summer will bring a wealth of events, starting with the AIAA/CEAS Aeroacoustics conference to be held on 4-7 June in Rome. The event promises to be the most successful of its kind in terms of participation and its organisation is under the responsibility of the AIDAA and the Roma Tre University. Just a few days later, the CEAS EuroGNC 2024 will be held in Bristol, on 12-14 June, with the support of the RAeS and the University of Bristol. The series is then concluded by the International Forum on Aeroelasticity and Structural Dynamics (IFASD), to be held on 17-21 June in The Hague.
The last event will be right at the end of the summer break, with the European Rotorcraft Forum (ERF) in Marseille on 10-12 September. The ERF is now at its 50$^{th}$ edition, a real success that started well before the existence of CEAS.
In addition to this impressive list, the two major aerospace conferences ICAS and IAC will be held in Italy, respectively in Florence on 9-13 September and in Milan on 14-18 October. Both events are managed by AIDAA and will see a great involvement of all the CEAS members. In particular, even not being directly organised by CEAS, these two large events will give us the opportunity to promote the Council, its activities and its journals, given the expected huge participation from all over the globe. This is a strategic action that the Council has approved, in the spirit of improving the CEAS visibility to the aerospace community.

Talking about visibility, it is a pleasure to see how the two CEAS Journals are slowly but steadily improving in terms of impact and papers, with the CEAS Space Journal already listed in the Web of Science and having an Impact Factor steadily growing over the last 5 years, and the CEAS Aeronautical Journal, albeit not yet included in the WoS, steadily listed in Q2 by the Scimago Journal Rank.
In the last year CEAS has put in place a couple of important actions that are instrumental to a proper management of all the papers proposed for the conferences. CEAS has completely reorganised its website that now incorporates also a permanent paper repository, capable of storing all the conference papers and with a smart search engine. This is completed by the possibility, from now on, to assign DOIs to the stored papers, for a permanent and unique identification.

The activities of CEAS for the incoming year will not be limited to the organisation of conferences, although these will absorb a lot of energy and resources. As common practice in the last years, we will continue our actions to improve the image and visibility of CEAS, we will assign awards for papers and professionals that have contributed greatly to the achievements within CEAS and the aerospace industry, and we will work further to improve the impact of our Journals.

With the support of three active and talented vice-Presidents, the Director General and our secretariat I am sure that CEAS will have a profitable and successful year.

■

# PRESIDENT'S REPORT FOR YEAR 2023

This has been my third term as CEAS President and the CEAS Board of Trustees appointed me as President of the Council for a fourth term for 2024. I am very much honoured and at the same time I feel a huge responsibility for what has been done in the recent past and what is waiting ahead of us.

This year has seen CEAS returning fully operational after the Covid pandemic, with no further need to organise fully online meetings and/or events, yet allowing remote participation in our scheduled Board of Trustees or General Assembly, practice that allows to enhance participation and save time and cost for someone, even if with a slightly reduced effectiveness.

It is not surprising to notice that the highlight event of 2023 has been the Aerospace Europe Conference 2023, jointly organised with EUCASS and marking the 9$^{th}$ CEAS conference. But this is not the only important achievement of the year, as reported next.

## AEC2023

The Aerospace Europe Conference 2023, joint 10$^{th}$ EUCASS and 9$^{th}$ CEAS conference, took place in Lausanne in July 2023. For the first time the event has seen a joint effort of two European entities, and this has been indeed a success according to the basic figures: over 700 participants, 34 countries represented, 40% of the participants were students. The largest groups in terms of countries came from Germany, France, Italy, and it is notable that we had also a large group from Korea marking the real international nature of the conference. The organisation involved around 130 Programme Committee members, equally shared between CEAS and EUCASS, and the conference programme included 20 scientific topics leading to 97 Technical Sessions, in 15 parallel rooms, plus 14 Plenary Invited Lectures. In total, 605 presentations including 65 Posters.

The CEAS contribution to the conference included approximately 50% of Programme Committee members, proposals for conference topics, identification of keynote presentations, contact with sponsors, provision of the IT tool for the conference management and secretarial support. CEAS also provided grants for student participation, offered to all its members and actually exploited by AIDAA, FTF, DGLR, RaeS and Euroavia.

The event offered the opportunity to deliver the 2022 CEAS Awards during gala dinner. Our awardees Johann-Dietrich Wörner and Dietrich Knörzer received the award in the spectacular scenario of the Olympic Museum in Lausanne.

## CEAS AT WORK

The year has been characterised by four Board of Trustees meetings, motivated by the necessity to discuss, and take important decisions. The most relevant are briefly discussed hereafter.

Despite the undeniable success of the joint AEC with EUCASS, the CEAS Board decided that the next AEC, marking the 10th CEAS conference, will be organised separately from EUCASS. This decision has seen a vast majority of consensus from the CEAS members, with different motivations. In the spirit of serving the European aerospace community, this decision can allow overall a higher participation understanding that one single major event might fall in a period not favourable to the entire community, while two distinct events, well separated along the year, indeed offer to anyone a higher chance of participation and knowledge sharing.

Regarding membership, the Von Karman Institute decided to reapply as a CEAS Corporate member. The Von Karman Institute had already been a CEAS member in the past and they would like to become a member and be involved in the organization of the AIAA/CEAS Aeroacoustics Conferences. Membership has been approved and will become effective starting January 2024.

CEAS has become member of DataCite which is the European non-profit organization that provides persistent identifiers (specifically DOIs) for research data and other research outputs. Joining DataCite as members allows CEAS to assign DOIs to all papers presented at the CEAS conferences, which will allow for the papers to become discoverable, citable and connected. This is what we and our technical committees want.

Along with the DataCite membership, CEAS has defined the procedure to allow conferences to be labelled as CEAS conference and furthermore some financial resources have been allocated to support publications in CEAS Journals for papers presented during the CEAS Conferences, in particular for those conferences that have procedures in place to identify the best papers.

For internal organisation, CEAS has also defined a clear procedure for the election of CEAS Officers. This procedure has immediately been adopted because of the resignation of Mrs Dominique Nouailhas from the position Trustee for 3AF. Mrs Dominique Nouailhas was also vice-president of External Relations and Publications, role that therefore needed a new nomination. The newly nominated vice-president of External Relations and Publications is Mr Lukasz Kiszkowiak, Trustee for the Polish society PSAA.

## CEAS AWARDS

In line with the decisions taken over one year ago, 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 2023 has been assigned to Mr Franco Ongaro, an example of an outstanding European career covering both aeronautics and space sectors, in private industries and public entities, with constant contact with academia and the younger generation. Mr Ongaro, for long time European Space Agency staffer, is currently manager for Leonardo's space division unit.

The CEAS Distinguished Service Award has been assigned to Prof. Zdobyslaw Goraj, my predecessor as CEAS President. His academic career at the Warsaw University of Technology (WUT) is remarkable and he played a very positive role in preparation of East-European teams to be integrated in European aerospace projects. He created the Polish Society of Aeronautics and Astronautics and for long time has served CEAS as Trustee for the PSAA and as President.
I also like to mention the awardees for the most cited journal papers.

For the CEAS AERONAUTICAL JOURNAL:

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## GENERAL ASSEMBLY AND BOT MEETINGS DURING 2023

The General Assembly was held only once, in November, while the BoT Meeting was held four times, in hybrid mode in April, July and November and pure online mode in September. The CEAS Board of Officers meeting was held also only once along the year, in October. At the end of the year, the CEAS Officers appointed for 2024 are the following:

- CEAS President, Mr. Franco Bernelli Zazzera.
- Vice-President Publications and External Relations, Mr. Lucasz Kiszkowiak.
- Elected Vice-President Awards and Membership, Mr. Anders Blom.
- Vice-President Finance, Mrs. Cornelia Hillenherms.
- 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, 08.01.2024.*


AIDAA ASSOCIAZIONE ITALIANA DI AERONAUTICA E ASTRONAUTICA
CEAS Council of European Aerospace Societies
AIAA

# INTERVIEW WITH BRUNO SAINJON, PRESIDENT AND CHIEF EXECUTIVE OFFICER OF THE FRENCH AEROSPACE LAB ONERA

**By Jean-Pierre Sanfourche, Editor in Chief**

*Bruno Sainjon, Ingenieur general hors classe de l'Armement*

*Engineer General of Armaments,* ***Bruno Sainjon*** *has held several positions within the French Ministry of Defence, including DGA Director of Operations, from 2009 to 2014, and in industry. In 2014, he was appointed CEO of ONERA by decree of the French Council of Ministers, a mandate renewed in 2015 and again in 2020. He was elected Chairman of EREA, the association of European Aeronautical Research Establishments, for two years (2015-2016), Chairman of ESRE, the European Space Research Establishments Associations 2021-2022), and in October 2023, Chairman of IFAR, the International Forum for Aeronautical Research. He is Commander in both French National Orders Légion d'Honneur and Mérite.*

**If we are to tackle all greenhouse emissions from air transport at 2050 time horizon, we must re-think aviation with the four-R of a 'circular economy': Redesign, Repair, Reuse, Recycle. This was the theme of the event jointly organised by the European Commission and the EREA, which was held at Le Bourget Air Show in last June. What are your comments about this general philosophy?**

Reducing the aircraft fuel consumption has been one of the main drivers of research and technological developments in the five last decades, focusing e.g. on aircraft aerodynamic efficiency, engine efficiency and reduction of the aircraft overall mass. From mostly economic at the beginning (allow affordable flights despite of high oil prices), the challenge changed its trajectory towards "sustainability" when environmental and societal questions (emissions, noise, etc.) started to be taken into account. "Decarbonisation", aiming at eliminating as far as possible fossil fuels for the propulsion of aircraft and reducing aviation's impact on climate change, is currently a hot topic that mobilizes enormous resources. However, at this stage, the impact of aviation on the environment is not completely addressed.

The current economic model (the Linear Economy: extract – make – use – dispose) has largely ignored the mineral resources scarcity on earth, especially those needed to implement the energy transition or to secure supply chains in strategic industrial sectors, two issues of high concern to the aviation industry.

Shifting to a Circular Economy is now vital, from both industrial and environmental perspectives: extract less raw materials by using "secondary raw materials" gained from manufacturing scrap recycling and waste recycling after aircraft dismantling, develop easy-to-recycle materials, increase the efficiency of logistics as well as manufacturing processes (use less materials while maintaining the same performance, less energy, less fluids...),


*Gullhyver - Flight © Onera*

reuse components and hence avoid landfilling, are some implementations of circularity principles. Low-environmental-impact criteria over the whole component life are now introduced when it comes to materials and design selection, of course in conjunction with cost and safety.
These were some of the topics highlighted at the EC-EREA event, exemplifying the involvement of the European Commission as well as the industry and research communities. Even if the aircraft manufacturing phase – in short – is only a fraction of the operation phase (twenty to thirty years), and the global environmental impact comparatively low at least in terms of emissions, it is a societal responsibility of the aviation sector to reduce its impact on both climate change and terrestrial resources. ONERA is e.g. active in the field of life cycle assessment as well as in improving the recyclability of high performance materials, especially metallic alloys or structural health monitoring systems to optimize maintenance processes and extend the lifetime of complex structures.

**What are the different technological and operational steps forward that need to be achieved to obtain a fully circular transport system by 2050?**
Circularity is only one of the solutions in order to achieve the objectives of a net 0-emission aviation by 2050. There are many others, which can be classified into two classes of solutions:

**1)** Consumption reduction: given the evidence that the best fuel is the one that you do NOT use, reducing the consumption remains very important. Additional efforts are done:
   - to introduce new technologies into the aircraft: high-aspect ratio wings to reduce induced drag of the airplane, very high by-pass-ratio engine (up to Unducted Fans: see RISE projet from Safran with GE) to improve the propulsive efficiency of engines, lighter advanced materials …: ONERA is present together with industry to maturate all these technologies, using our knowledge and our methods and tools (numerical simulations, experimental facilities: wind-tunnels)
   - to improve the efficiency of the Air Traffic System: study of formation flight (demos done using an ONERA Lidar in the ATOLL/Fellow-Fly projects by Airbus), optimization of the work done by air controllers with tools like SINAPS using AI and developed by ONERA and that will be deployed by DSNA in their air traffic control centers

**2)** Reducing the carbon intensity, which means using low-carbon fuels, be it bio-fuels (based on biomass), e-fuels (synthetic fuels), completely decarbonized fuels like Hydrogen directly burnt in engines or even electric or hybrid-electric powered aircraft (for the smallest of them).

So, the range of solutions is wide, each of them being more or less well adapted to each of the aviation segments.

**Could you present the main aerospace decarbonisation research projects ONERA is presently conducting within the EREA framework?**
I can mention 3 projects initiated in the EREA context and in which ONERA is particularly active. Of course, such projects complement the research done in other national or international contexts:

**1)** IMOTHEP: this is an EU project coordinated by ONERA and involving 30 partners, which aims at defining the possibilities and the limitations of hybrid-electric distributed propulsion for reducing the emissions of commercial aircraft. Hybridization has been studied for both regional and short medium range aircraft based on top level aircraft requirements (TLARs) defined by airframers. Based on these TLARs, hybridization clearly appears as a huge step for the SMR due to the involved electric power and the required distribution voltage (about 3 kV), while the potential benefit is not demonstrated at this stage. Hybridization seems more applicable for regional aircraft, for which a particularly interesting configuration has been identified in the project. For regional also, the technological gap is much lower, even though there is still an important effort to be done to maturate the required technologies. The project will end in the coming months and issue a final roadmap for the development of hybrid electric propulsion.

**2)** DEMOCRITE: this is a pure EREA project on the topic of cryogenic tanks required to store Hydrogen in liquid phase. It started in 2023, so it is not yet possible to give some results. But what is interesting in this project is that for the first time, 3 EREA organizations have decided to team in project mode using their internal resources and sharing all the results.

**3)** PULSAR and Impact Monitor: these are HE and Clean Aviation projects where EREA has taken the lead in order to evaluate the impact of aviation emissions at the global level. We are not only considering the gaseous emissions of the aircraft in flight but also around the airports with the resulting pollution; and also the acoustic emissions and their nuisance on the population. What needs to be considered in this global context is also all emissions other than CO2, that is to say NOx and even condensation trails (contrails) that have a significant impact on global warming (these non-CO2 effects are investigated by ONERA with IPSL in the context of the national CLIMAVIATION initiative). Within PULSAR for instance, we will provide policy-makers and the European commission with recommendations on research to be supported on noise and emissions in order to cope with the objectives of the EU environmental policies such as "Fit for 55".

**What is the development status of the EREA Future Sky Joint Research Initiative, with emphasis put on ONERA's contribution?**
FUTURE SKY (FS) is a Joint Research Initiative of the Association of European Research Establishments in Aero-

nautics (EREA) devoted to preparing key technologies and capabilities for a green and seamless air transport in Europe.

FUTURE SKY aims at defining Roadmaps related to Themes that are of common interest among EREA members. We are in a kind of transition between 'old' Themes (there were 6 of them) and 9 'new' Themes that have been defined in order to better fit with the ambitions of ACARE and its 'Fly The Green Deal' Ambition published in June 2022. Among these 9 themes, ONERA has taken the lead of 3 of them:

- Aviation Impact on Society: a topic I have already discussed above through the PULSAR and Impact Monitor projects
- Sustainability & Circularity for Aviation: see question Q1
- Security for Aviation: this is a Theme covering the identification of threats for aviation (aircraft, systems, airports…) and how to prepare scenarios to neutralize these threats. An important aspect of this theme is related to cyber-security since the cyber threats are developing and will continue to do so in a more and more digital world.

**How is ONERA participating in Clean Aviation programmes?**

After a significant participation in Clean Sky and Clean Sky 2 programmes, ONERA was involved since the very beginning in the Clean Aviation programme through the preparation of the Strategic Research and Innovation Agenda. We participated therefore in the early phases of the programme definition and are a founding member of the Clean Aviation partnership. ONERA also seated the first two years of the partnership at the Governing Board as research organization representative and is permanently represented at the Technical Committee.

We are now participating in eight projects selected in the first Call for Proposal and are currently preparing the start of the three projects selected in the second Call for Proposal. Two important point to underline: all proposals we participated in were selected; and we are coordinating a project in call2, AWATAR (Advanced Wing mATuration And integRation) dedicated to the design maturation of a very high-advance ratio wing with technologies such as laminarity, advances integrated leading-edge systems, integration of open-fan propulsion system.

**How is ONERA participating in SESAR programmes?**

After being a linked third-party in SESAR and SESAR 2020 since 2008, ONERA is now a full Founding Member of the SESAR 3 partnership (2022-2031). We are involved in several Industrial and Exploratory research projects.

To start with, we want to develop new methodologies for air traffic management, such as intelligent flow management systems. We have been working on this subject in cooperation with DSNA since SESAR 1.

ONERA is also investigating ways to assess and reduce the environmental impact of air traffic, such as reducing fuel consumption and emissions and optimizing trajectories, in coherence with the aviation decarbonization objective, and assessing noise of the drones traffic, in order to manage it better.

We are also involved in the civil/military interoperability and coordination, flagship, which suits well with our dual status.

**How is ONERA collaborating with the UK Aerospace Research Centres?**

While Brexit led to a drastic reduction of the cooperation within the European framework program over the last 3 years, ONERA's scientific cooperation with British universities has continued (Southampton, Cranfield, etc.). More recently, close relations with ATI (Aerospace Technology Institute) have been set up, notably to exchange on the decarbonisation roadmaps. As of 1st January 2024, the United Kingdom becomes an associated country to Horizon Europe, which paves the way to a better collaboration in the next few years.

Cooperation with the UK is generally more complicated to manage in a strategic and coordinated manner, as there is no single research organization mandated on behalf of the overall aerospace research community in UK. EREA has chosen to accept the National Composite Center of UK (NCC-UK) on its board while IFAR is currently evaluating the application of ATI. IFAR - in the hands of ONERA which holds the presidency of the forum, is currently THE worldwide network of research technical organisations working in the field of civil aviation and relies on 27 institutions, foremost among them, NASA, JAXA, DLR, ONERA….

**What are the military aerospace research projects ONERA is conducting within a European framework: helicopters, UAV-RPAS …?**

ONERA participated to the high-speed helicopter demonstrator "RACER" developed by Airbus Helicopters in the Clean Sky2 program with significant contributions in the propellers and the vertical fin design. ONERA also provided tools for the acoustic assessment of the configuration, which is expected to have its first flight soon. This is now continuing in the European Defense Fund context with participation to the ENGRT project dedicated to prepare future military rotorcraft capabilities, including high-speed.

ONERA is also working on man-unmanned teaming between a helicopter and a UAV, with in particular considerations of the human factor issues.

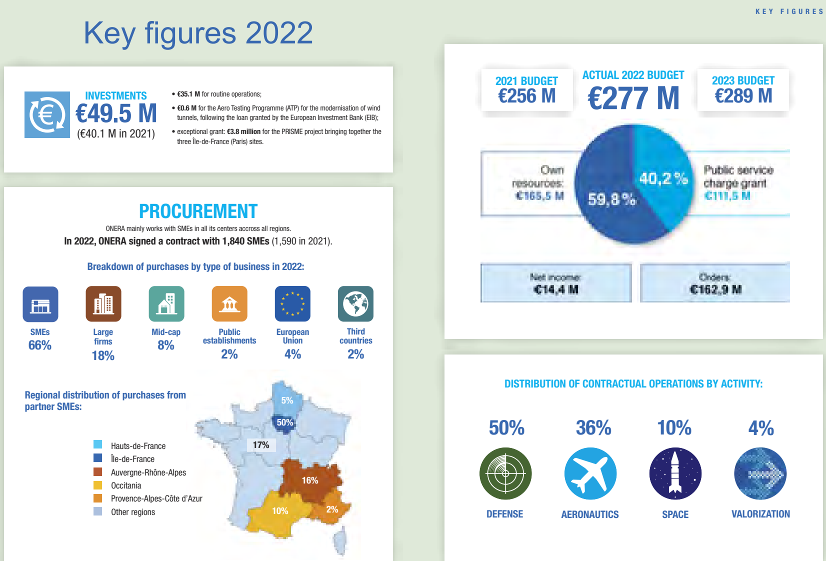
ONERA has also contributions in the field of UAVs, in particular for flights in non-segregated airspace, a key element for the EURODRONE flagship (the Medium Altitude Long Endurance Remotely Piloted Aircraft System (MALE RPAS), a crucial capability for Europe's strategic Autonomy) and the Tactical UAVs (such as SAFRAN"s Patroller and Leonardo's Falco). Notably, ONERA cooperates on the development of a European Low Swap Radar for a non-collaborative Detect And Avoid solution for tactical UAVs. In the same field, ONERA is also involved in coordination and interoperability of civil and military activities for shared airspace and provides its wide expertise to support our MOD.

**Could you say some words about the hypersonic military aircraft project 'Espadon' ?**
The main objective of the ESPADON internal research project is to study a military hypersonic aircraft concept that could be developed in the distant future (20 years and beyond). Initially, based on credible operational scenarios, the goal is to size an aircraft, and from there, to define and identify the necessary technological building blocks. Furthermore, this initiative involves anticipating and analyzing emerging threats that our defense systems will encounter in the future.
Through this initiative, ONERA is fulfilling two of its missions: i) Monitoring and providing expertise for the French Governmental Defence Procurement and Technology Agency (DGA) and the Ministry of the Armed Forces; ii) Innovating and exploring foresight concepts.
The project builds upon ONERA's legacy in hypersonic flight activities dating back to the 1950s, leveraging the organization's expertise in aerodynamics, propulsion, materials, thermal management, and stealth.
As a state operator under the supervision of the Ministry of the Armed Forces, ONERA contributes to providing France with aeronautical and space equipment at the highest level

**In conclusion, May I ask you to tell us the first priorities you assign to ONERA for the Year 2024?**
In a context of major strategic change, France has adopted a new military programming law covering the period 2024-2030, which now constitutes the strategic compass for our defence and should enable us to direct our research to respond to the needs of tomorrow. So the first priority is to meet the DGA's request to renovate our two nuclear components, and the second is to prepare the SCAF programme. This has very concrete implications, especially in our windtunnels, which have been increasingly involved in military projects over the past two years. Combat aircraft and weapons will represent a significant part of Modane's facilities workload in 2024.
In the area of civil aeronautics, all our efforts are aimed at meeting the requirements of the roadmap for decarbonising air transport drawn up under Article 301 of the Climate and Resilience Act. These requirements generate research work in many of Onera's core areas of expertise, such as aerodynamics, propulsion, materials, fuels, and in particular hydrogen. In addition, this amounts to another significant part of our windtunnels' priorities in 2024. Namely, our S1MA windtunnel, because of its size and its capacity to simulate engines, is unique to support civil aviation's innovations, especially when we intend to improve the efficiency of the engine or the engine integration. It will be key for civil aviation developments in 2024 and the coming years.
In the space sector, we are focusing mainly on space surveillance technologies (radar and optics), optical telecommunications, space borne accelerometers and gravimetry technologies.

# Annex

**ONERA, the French Aerospace Lab**
ONERA is the French national laboratory for aeronautics and space R&T, staffed by 2000 people. Under the supervision of the French Ministry of Armed Forces, ONERA has an annual budget of 289 million euros (2023), over half of which comes from study, research and testing contracts. As the French expert in aerospace technologies, ONERA prepares tomorrow's defenses, meets the aerospace challenges of the future, and contributes to the competitiveness of the European aerospace industry. ONERA masters all the disciplines and technologies in its aerospace fields.
All major civil and military aerospace programs in France and Europe contain "DNA" from ONERA: Ariane, Airbus, Falcon, Rafale, missiles, helicopters, engines, radars, etc.



# OUR 2050 IS NOW: PIONEERING GREENER AIRCRAFT

**Axel Krein, Executive Director, Clean Aviation Joint Undertaking**

CLEAN AVIATION

*Axel Krein, Executive Director, Clean Aviation Joint Undertaking*

Aviation must introduce significantly cleaner aircraft into service by 2035 to achieve the sector's climate neutrality goals by 2050. The Clean Aviation programme, co-funded by the European Union, is delivering the game-changing aircraft technologies before 2030 to enable it to happen.

We need to innovate, accelerate and very importantly collaborate. Recently, we announced 8 additional daring projects as part of our second call for proposals (Call 2). Their innovations will help to reduce fuel burn and net emissions of greenhouse gases for commercial air travel by no less than 30% compared to the state-of-the-art aircraft models available today. Thereby paving the way towards an entry-into-service of new, highly efficient aircraft by 2035. Together with the use of synthetic fuels or hydrogen as an energy carrier, greenhouse gases will be reduced by approx. 90%.

## DARING PROJECTS TO SPARK AN AVIATION TECHNOLOGY REVOLUTION

Currently, the greatest opportunities to make air travel more environmentally friendly lie in the short-medium range segment. Approximately 55% of emissions are produced on routes below 4000km in length (approx. Brussels-Cairo). As such it is precisely within the regional and short-medium range commercial aircraft sector where Clean Aviation is directing its efforts.

## SPEED IS OF THE ESSENCE

We are actively working on a radical revolution in aviation technology and aspire to leapfrog a generation of aircraft. With a total project budget of €380 million, including €152 million in EU funding through the Horizon Europe programme, our new set of projects from our Call 2 will target novel aircraft concepts, innovative propulsion architectures, and new fuselage and wing designs. This complements Clean Aviation's initial 20 projects funded with more than €650 million in EU funding (approx. €2 billion in total volume of activities including in-kind contributions). Work on these 20 projects is advancing well to develop cutting-edge innovations including electric propulsion systems, a hydrogen and hybrid gas turbine design and the next generation of high-power fuel cells.

## A PATH TO 75% FLEET RENEWAL

In the coming years, those 28 daring Clean Aviation projects in total will explore new electric and hybrid-electric concepts, ultra-efficient short-and-medium aircraft architectures, and disruptive hydrogen-powered technologies. From 2025 onwards, we will direct our efforts on accelerating the maturation and demonstration of these technologies with ground and flight test activities starting as early as 2026.

In practical terms, this means that airlines will be offered new aircraft with Clean Aviation's technologies inside within the Clean Aviation's programme lifetime. The combined technological and industrial readiness focus will enable the replacement of 75% of the world's civil aviation fleet by 2050.

But back to the here and now, Clean Aviation is focusing on technologies applicable for aircraft in the short-to-medium haul sector. Whilst some of those technologies have the scope to be scaled up for use in aircraft for long-haul travel, others need to be developed specifically for this sector which accounts for approx. 45% of current $CO_2$ emissions. An important challenge not to be forgotten!

## NEW FORMS OF COLLABORATION NEEDED

This current decade offers an unprecedented opportunity to redefine the aerospace industry with heightened environmental awareness converging with technological breakthroughs.

The key to success in the journey towards sustainable aviation lies in close cooperation and alignment between all aviation stakeholders to reach our shared climate neutrality goals. Public-private partnerships like Clean Aviation are crucial in the European context to harness expertise and resources from both the public and private sectors. At Clean Aviation we bring together close to 300 entities representing 24 different countries from across the aeronautical community. This builds on intensive cooperation between large industrial entities, SMEs, research centres and universities, including the European Aviation Safety Agency (EASA)

Most of all, the entire aviation sector needs to find new ways to collaborate to make sustainable aviation a reality. This includes the entire ecosystem: airlines, airports, policymakers, regulators, manufacturers, energy producers, scientists, innovators and so on. Their active involvement and contribution are paramount. Our 28 daring Clean Aviation projects are an important piece in this puzzle, and only through joint efforts can we achieve a future where flying is clean. Let's make it happen together.

*Sourcce : Axel Krein Linkedin*

# EREA POSITION ON THE EUROPEAN INNOVATION FUND

Published in the EREA Newsletter November 2023

EREA Association of European Research Establishments in Aeronautics

The European Innovation Fund (EIF) is one of the world's largest funding programmes for the demonstration of innovative low-carbon technologies and its potential to contribute to greenhouse gas reduction is significant. EREA actively encourages the community to seek opportunities for aviation to share in this potential for innovation to make aviation more sustainable. EREA identified strong theoretical complementarity with other key European funds but also major shortcomings preventing the aviation community to fully access the potential offered by the EIF. To overcome these shortcomings and allow the EIF to really support innovation for sustainable aviation, EREA shares the following recommendations:

1. **EIF is not well connected to Horizon Europe (HE), causing a disruption in the innovation process** HE projects reaching the highest possible TRLs allowed may not be sufficiently ready for EIF calls.

**Recommendation 1:** Reserve a part of the EIF budget for large-scale demonstrator projects or pilot lines to help bridge the gap. A dedicated set of award criteria is needed that recognises some demonstrators alone will not significantly reduce emissions, but the products and services that are built upon them eventually will. Such projects can pick up where HE projects must end, ensuring a real transition between the two programmes, fully overcoming the "valley of death".

2. **Emission reduction award criteria unsuitable to support the aviation industry's challenges**

Projects are expected to directly reduce emissions within a certain timeframe, often 10 years, which does not take into consideration the extremely long time to market in the aviation sector, leaving aviation disadvantaged to comply with the criteria to have projects awarded in the EIF.

3. **Aviation disadvantaged with other less difficult to abate sectors when in the same call**

Even if aviation partners can put forward a proposal with significant emission reduction potential, it would still be very difficult to compete with projects in other less difficult to abate sectors that are often able to promise and deliver a much more direct and short-term emission reduction with relatively reduced prior investment requirements to reach the same maturity levels.

**Recommendation 2:** To prevent unfair competition, aviation should have a dedicated call where aviation projects compete with one another on a fair and level playing field. Alternatively, the GHG emission reduction award criteria could be tailored to the eligible sectors applying and weighted to create a level playing field across all sectors.

4. **No funding for key framework conditions for innovation such as Technology Infrastructures (TI)**

To test, validate and eventually scale-up technologies, products and services, it is important that the appropriate enabling infrastructures are available. The EIF is excellently positioned to fund TIs, complementing the EU's framework programme and significantly accelerate time-to-market.

**Recommendation 3:** Create, in close coordination with the EU Research & Innovation Framework Programme, a dedicated instrument to fund necessary test and validation infrastructures that are needed to test, validate and certify innovations to reach the market in a timely and safely manner.

5. **Adequate recognition and catering to key specific innovation enabling partners in projects**

The logic of public intervention is clear: the higher the technology readiness level (TRL), the lower the public investment and the more private investment is to be expected. However, Not-for-Profit Research Establishments, very much active in the mid- to high-TRL range, would not be able to participate in EIF projects if their costs are not suitably covered. Catering for their participation acts as an enabler and accelerator to innovation, recognising the key role they play in supporting the overcoming of the "valley of death" and their benefit to society.

**Recommendation 4:** Allow for an exception to reduced funding rates, similar to the one in the Horizon Europe Rules of Participation Regulation [1]

## Conclusion

The current EIF favours short-term impacts over long-term ones, and, in principle, EREA does not believe that is a bad thing. However, the notion of short term and long term is relative when taking into account particular industries' and technologies' market dynamics. Short term for aviation means 13 years from now, with significant investment barriers to overcome for new safe and certified products and services. Therefore, if we do not act now, we will not only miss the 2035 deadline for the next small to medium range aircraft, but we will also loose the window of opportunity for other aircraft types. We will need to wait another 30 years before we get another chance. The impact of inaction may not seem to be very high today, but it will last for decades.

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*1] Horizon Europe Rules of Participation (2021/695) – Article 34-1(b)*

You can read all the details in the complete EREA position on the European Innovation Fund.

## ABOUT EREA

**EREA, the association of European Research Establishments in Aeronautics is a non-profit organisation which gathers Europe's most outstanding research centres active in the field of aeronautics and air transport.**

**6.116**

**EMPLOYEES IN AVIATION RESEARCH**

**€ 616.000.000**

**SPENT ON RESEARCH IN AVIATION**

**CONTACT INFORMATION**

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## EREA ANNUAL EVENT 2023 AND EREA BOARD MEETING

Łukasiewicz Institute of Aviation

**Representatives of leading research institutions associated in the EREA met in Brussels for an annual meeting summarizing their activities to date. The discussion included the future of the aviation sector, challenges in the field of green transformation and support for R&D projects. The event was also an opportunity to summarize the two-year term of office of the Łukasiewicz – Institute of Aviation director, Paweł Stężycki as the chairman of EREA.**

The director of Clean Planet, Rosalinde van der Vlies, thanked director Stężycki for increasing cooperation within EREA and with the European Commission itself, as well as for his substantive contribution and work for the European aviation sector.

"I am extremely grateful to the members of the association's management board for the trust they placed in me by entrusting me with the mission of managing such an important European institution as EREA, two years ago. During this time, cooperation between institutes and in the aviation sector has been improved. We also built a new forum for building relationships between scientists, undertook joint initiatives with the European Commission and implemented the first projects financed by EREA. The Łukasiewicz – Institute of Aviation also deepened its involvement in the association's work. I believe that this is just the beginning of a strong presence in EREA for the Institute", says Paweł Stężycki.

From January 1, 2024, the new president of the EREA association will be Antonio Blandini from the Italian research institute CIRA.
During the event, the EREA Best Paper Award was also presented – this year, the competition for the best scientific publication was won by ONERA

# eXTRA PERFORMANCE WING DEMONSTRATOR TAKES-OFF

UpNext Airbus

## First flight establishes baseline for future fuel consumption reductions


**Led by Airbus subsidiary and technology incubator UpNext, the eXtra Performance Wing project aims to improve flight performance and respond to environmental concerns by completely rethinking aircraft wings as we know them today.**

Using biomimicry – biologically inspired engineering – the project seeks to develop a wing that can change shape and form during flight to maximise its aerodynamic efficiency. If the concept is successful and integrated into new aircraft, it has the potential to significantly reduce fuel consumption.

The November first flight was an important milestone for the project because the demonstrator is fitted with the exact systems that it will have when the eXtra Performance Wings are installed for flight testing starting in 2025. The data gleaned from this and subsequent flight tests will allow Airbus engineers to measure important baseline performance metrics that will be used to determine the impact of the new wing design, such as reductions in $CO_2$ emissions and fuel consumption.

While the eXtra Performance Wing technologies could be applicable to any kind of aircraft and propulsion system, the chosen demonstrator is a modified Cessna Citation VII business jet. As the targeted wingspan of the eXtra Performance Wing is more than 50 metres (that's long: an A320 wingspan is 35.8 metres), the Cessna's 16 metre wingspan represents an approximately one-third scale model of the final design.

"Things are evidently simpler at a smaller scale," says Sebastien Blanc, eXtra Performance Wing Technical Director. "But we chose the Cessna specifically because it constituted the best trade off between project complexity and representativeness of the final design."

### THE EXTRA PERFORMANCE WING: A DESIGN OVERVIEW

Launched in September 2021 the eXtra Performance Wing project is part of Airbus' Wing Research portfolio. This project explores some of the many technologies that could one day be integrated into the next-generation of Airbus aircraft, and complements the Wing of Tomorrow programme. Airbus UpNext seeks to fast-track future technologies by developing radical technological breakthroughs in an agile environment.

The overall goal of the eXtra Performance Wing project is to provide multiple wing configurations that dynamically adapt to flight conditions. The design incorporates innovative active control technologies as well as physical changes to the wing structure. Gust sensors on the front of the aircraft will register changes in turbulence, triggering relevant adjustments to the control surfaces of the wing. "This system is designed to be entirely automatic," says Blanc. "The eXtra Performance Wing technologies, which change the shape of the wing by mimicking


a bird's feathers, will adjust automatically to maximise aerodynamic flow."

There are also the hinged wingtips, which have a dual purpose. On the ground they prevent the aircraft from exceeding the maximum wingspan length that can be accommodated at airport gates (36 metres), and in the air they are flexible, able to change shape to avoid putting too much pressure on the wing. The wingtips also allow for a longer span to be achieved, increasing lift and reducing drag.

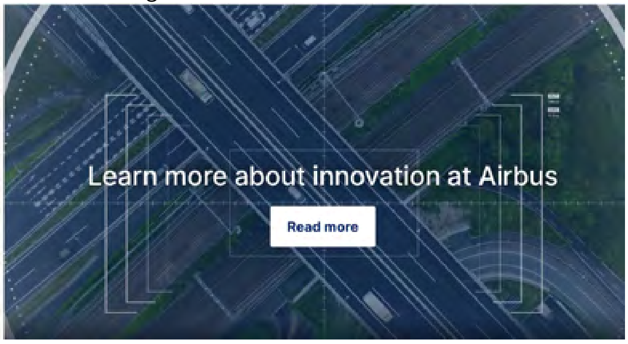
To ensure the feasibility of the concept, a 3D-printed wind-tunnel model has already been tested extensively at low speeds at Airbus' wing research facility in Filton, UK. With testing now completed, the design has been finalised and manufacturing of the different wing parts has already begun. The eXtra Performance Wing demonstrator's production is a classic example of collaboration between Airbus' four founding nations: the UK is manufacturing the wings, Spain will build the folding wingtips, and the high lift system will be designed in Germany. The modification and assembly of the aircraft will take place in France.

## UP NEXT: TOUCH DOWN IN CAZAUX, FRANCE

Once the initial flight testing has harvested enough baseline data, the demonstrator will be flown to Cazaux, France, where it will be based for the remainder of the project. A remote operation system will be integrated into the aircraft, followed by flights to test the communication between the 20 antennas on the aircraft and the control centre on the ground. Then, in 2024, the eXtra Performance Wings will be attached to the Cessna and undergo ground testing before the first flights begin in 2025.

The demonstrator will be remotely piloted during flight testing to enable UpNext's engineers to push the technologies onboard to their limits. As the Cessna is only a demonstrator and will not be put into production, the decision to have a pilot test the plane from a ground centre instead of onboard also alleviates the need to certify the demonstrator for human flight. "We want the flight testing to expose the eXtra Performance Wing to as many realistic flying situations as possible. This will give the different technologies the best possible chance of proving themselves, and of one day being integrated into the wings of tomorrow," explains Blanc.

The results of the remotely piloted flight testing will determine the success of the different technologies, but already Blanc says the project is paying off: "We are already seeing the fruits of our labour, and we have learned so much along the way. We have a real opportunity here to make a contribution to reducing fuel burn. Just having the potential to change the aerospace industry like this is huge."




*Source : https://www.airbus.com/en/newsrooom/stories/2023-11-extra-performance-wing-demonstrator-takes-off*

## AIRBUS UPNEXT

**Flying future technologies today**

Airbus UpNext focuses on flying future technologies at speeds well beyond what seems feasible today. In doing so, it is actively shaping the future of the aerospace industry.

**Mission**

Airbus UpNext's demonstrators evaluate, mature and validate potential new products and services that encompass radical technological breakthroughs. It has three flagships locations in France, Germany and Spain, to rapidly develop and test future technologies in scaled applications.

**Its mission is:**

To identify trends and technology concepts disrupting the future of aerospace - from both inside and external to Airbus - and evaluate them as potential viable products.

To further accelerate traditional research cycles, developing proof of concepts and completing both ground and flight testing with scale and speed. Each demonstrator takes on the challenge to deliver critical learning within a two to three year time frame, engaging our people and partners with purpose.

**People**

The people at Airbus UpNext keep one foot in the present and one foot in the future. They are solution-oriented, value-driven and come from different backgrounds and sectors. With a hands-on approach to bringing future technologies to life today, the people working at Airbus UpNext deliver value-add aerospace innovation by staying one step ahead.

# CICONIA – CLIMATE EFFECTS REDUCED BY INNOVATIVE CONCEPTS OF OPERATIONS


## CICONIA IS AN INDUSTRIAL PROJECT AIMED AT DEVELOPING SOLUTIONS TO MITIGATE THE CLIMATE IMPACT OF AVIATION.

*Project coordinator Philippe Masson, from Airbus, explains.*

**What is the rationale of the CICONIA project and what are its main objectives?**
CICONIA supports the European Union's ambition of reaching climate neutrality by 2050, focusing on the challenge of aviation climate impact as non-$CO_2$ emissions contribute about 2/3 of the net Effective Radiative Forcing (ERF) (Lee etal, 2021)
Nion-CO2 impacts, and in particular effects of persistent contrails, could be encompass.
CICONIA goal within SESAR 3 is to bring together all key stakeholders to support the development of environmentally effective, economically balanced, and operationally viable (safe) mitigation measures.
What are the top three challenges in addressing Non-$CO_2$ effects of aviation/mitigating these effects?
- Development of reliable weather forecast products.
- Modelling of climate impact at the scale of the aircraft trajectory and taking into account uncertainties.
- Operational mitigation measures feasible at scale without compromising safety.

**How has this project built on the work of previous SESAR innovation projects?**
The previous research projects have provided a methodology to define climate optimised aircraft trajectories (ConSA, ATM4E, FlyATM4E, CREATE). CICONIA will gather the expertise developed in these projects and will bring the operational expertise (Airline operation, ATM and ATC, OEM knowledge) to define an efficient climate mitigation operational concept.

**What are the expected outcomes and benefits of this project?**
Project outcomes are expected to be the following:

- First version of weather forecasting to support contrail mitigation measures accompanied by a recommendation and perspective for their improvement (eg. specification for new humidity sensing, perspective in space remote sensing, ...).
- Standardised industry wide climate impact models: bringing together experts across the industry, regulators and academia, these climate impact models will be validated in CICONIA and could function as the future reference used by EU ETS or CORSIA to evaluate the climate impact of individual flights and the effectiveness of incentive or regulatory measures.
- Flight planning, AFTM and ATM operational recommendations; CICONIA, CONOPS (concept of operations) will enable operational consensus on the correct and operational impacts..

### ACRONYMS

**ATC:** Air Traffic Control
**ATM:** Air Traffic Management
**AFTM:** Association Française de Trafic management
**EU-ETS:** European Union - Emissions Trading System
**CORSIA:** Carbon Offsetting and Reduction Scheme for International Aviation
**ERF:** Effective Radiative Forcing
**OEM:** Original Equipment Manufacturer

*Document dated Nov. 27,2023*
*Source : https://www.sesarju.eu/news/ciconia*

# HOW USEFUL IS ARTIFICIAL INTELLIGENCE IN AIR TRAFFIC MANAGEMENT?

*Nov. 29, 2023*

**Just how useful is artificial intelligence in air traffic management? That was at the heart of discussions of day 2 of the SESAR Innovations Days (SIDs) in Seville on 28 November. Experts headlined some of the operational use of cases wher artificial intelligence applications are being trialled through research and innovation, as well as some of the challenges facing acceptance and implementation of this promising technology.**

Hosted at the University of Seville, the SIDs plenary was moderated by Ruben Flohr, ATM Expert, SESAR 3 JU and brought together a lineup of experts in the field of artificial intelligence and automation in ATM, namely, Giuseppe Contissa, Professor, European University Institute, Jose Manuel Cordero, CRIDA/ENAIRE, Luis Barbero, GATCO Director, Heathrow Approach Air Traffic Controller, Paula López-Catalá, Programme Manager, Innaxis Research Institute, and Ramon Dalmau-Codina, Data Scientist, EUROCONTROL (Winner of SESAR Young Scientist Award 2017)

ATM is an ideal candidate for greater automation and augmentation through AI. With their repetitive procedures generating huge amounts of data, aviation and ATM can make use of AI and higher levels of automation to improve the efficiency of their operations in many ways and allow human operators to focus on safety-critical tasks.
Here are just some of the use cases where AI is being trialled through SESAR research and innovation:

**Airport / Tower surveillance**
Taxiway inspection (i.e. bird hazard, presence of drones, drones and the need for drone protection, autonomous vehicle monitoring, human intrusion, etc.) and runway monitoring (approach and landing) misalignment warning.
Read about the TRUSTY project

**Traffic hotspots**
AI-based flow management Position (FMP) function to predict and resolve traffic hotspots.
Automatic support for hot spot analysis and resolution, integration of constraints and dynamic airspace configuration (DAC). Data driven trajectory prediction.
Examples of projects addressing this use case: ASTRA, HARMONIC, ARTIMATION, DART

**Network state monitoring**
Prediction and management of network critical states and degraded performance


See SESAR Solution Collaborative network performance management (PJ.09-W2-49)

**Smart sectorisation (SMARTS)**
Dynamic airspace configuration and the design of "smart sectors". This covers the design of basic volumes of airspace with optimal distribution of workload, tailored around specific safety and operational requirements, including complexity.
Read about the SMARTS project

**Optimised runway delivery**
Enhanced optimised separation delivery with machine learning uses more accurate predictions of final speed profiles derived from advanced big data / machine learning techniques.
See SESAR Solution: Enhanced optimised runway delivery for arrivals (eORD) with machine learning (PJ.02-W2-14.6a)

**Controller and pilot decision support**
Various AI solutions solutions (digital assistants) to support Pilots, ATC operators and Airport operators in non-safety and safety critical operations (Fast-track - exact functionality not yet defined)
Examples of projects addressing this use case: TAPAS, MAHALO, AISA, JARVIS, DARWIN

**Dynamic reconfiguration of airport resources**
Airport-airport coordination in strategic and pre-tactical phases based on airport stakeholders and network requirements, including both information and predictions.
Read about the FASTNet project

**Improved adverse weather forecasting + impact on network management**
Integration of AI-based convection prediction models within air traffic flow management (ATFM) operational tools. Improve prediction of additional weather pheno-

mena impacting aviation (turbulence, low visibility, high altitude ice crystals, SO2 and dust). More precise characterisation of demand and capacity imbalances due to convective weather.
Examples of projects addressing this use case: ISOBAR, KAIROS

**Speech recognition**
Automatic speech recognition (ASR) to reduce the amount of manual data inputs by air-traffic controllers (using also airspace structure and radar data)

Examples of projects and solutions addressing this use case: MALORCA, HAAWAII, Virtual/augmented reality applications for tower (PJ.05-W2-97) and automatic speech recognition (PJ.10-W2-96)

**U-space**
U-Space advanced (U3) 'separation management service'
Examples of projects addressing this use case: BUBBLES, USEPE

**Understanding airspace users' preferences and behaviour**
Modelling of trajectories and estimation of non-observable variables from historical air traffic data. Particular attention will be paid to the estimation of variables related to AUs' preferences and behaviour (e.g., airline cost functions).

Read about the SIMBAD project

**Passenger behaviour**
Characterisation of passengers and journeys attributes, aimed to capture relationships between the target variables missing in the mobile network data (i.e., number of persons travelling together and number of bags) and the explanatory variables that are present both in surveys and mobile network data (e.g., place of residence, purpose of the trip, last mode of transport used to access the airport).

Examples of projects addressing this use case: IMHOTEP, BigData4ATM, MAIA, MultiModX

**ICT security**
AI based surveillance of network load distribution to detect anomalies. Usage of AI for PEN testing. Usage of AI for systems hardening. Software defined networking.

Read about the SINAPSE project
More the CORDIS Results Pack on AI in ATM

*Source : https://www/sesarju/eu/news/*

# AI TO ADVANCE SINGLE PILOT OPERATIONS: THE SESAR DARWIN PROJECT

## DARWIN : Digital Assistance for Reducing Workload & Increasing collaboratioN

sesar JOINT UNDERTAKING

***Nov. 24, 2023***

The SESAR DARWIN project aims to leverage artificial intelligence and advance single-pilot operations in Europe. Research will focus on a human-AI collaboration system, defining clear roles and responsibilities with human pilots remaining the ultimate decision-makers.

Challenges that currently prevent air transport aircraft to be manned by a single pilot include the need to keep cockpit workload sufficiently low to allow one person to address even the most demanding situations; the need to replace the second pair of eyes to cross-check actions of the pilot in command; and the need to detect and mitigate a pilot incapacitation. Human-AI teaming can help support pilots in each of the scenarios above.

"A need for higher autonomy requires digital transformation. For both, we need to build trust in AI-based solutions. DARWIN will develop a scalable human-AI collaboration concept that can gradually introduce new functions and pilot assistants, in line with the EASA AI Roadmap," said Jolana Dvorska, senior research and development manager and architect for SESAR at SESAR Founding member, Honeywell Aerospace, the lead in the DARWIN consortium.

Funded within the framework of Horizon Europe and the SESAR 3 JU's Digital European Sky programme, the project will develop AI-powered digital assistants and a human-AI collaboration framework to support both

extended minimum crew operations and single-pilot operations, ensuring the same (or higher) level of safety and same (or lower) workload as operations with a full crew today. The project will deliver solutions that enable operational efficiency, such as pilot state and task monitoring, with the complexity of the future airspace in mind.

The consortium consists of industry technology providers, aircraft OEMs, leading research institutes, air navigation service providers, and key European institutions and regulatory bodies. Project partners include Pipistrel, DLR, Eurocontrol, EASA and Slovenia Control. Work will be led from Honeywell's international development center in Brno, Czech Republic. account routing and other considerations.

### PROJECT INFORMATION

- **Grant agreement :** ID 101114733
- **Project type :** FAST TRACK
- **Flagship :** Artificial Intelligence for aviation
- **SESAR programme :** Digital European Sky
- **EC signature date :** 9 June 2023
- **Start date :** 1 June 2023
- **End date :** 31 May 2026
- **Funded under Climate Energy and Mobility**
- **Total cost: €5 163 172, 25**
- **EU contribution: € 3 460  077, 00**
- **Coordinated by HONEYWELL INTERNATIONAL SROCzech Republic**

More about DARWIN

*Source :*
*https://sesarju.eu/news/ai-advance-single-pilot-operations*

# COLLABORATIVE AIR AND SPACE COMBAT OPERATIONS


**The Air and Space Academy and DGLR have together conducted a deep study on the way to build collaborative capabilities in Europe from the initial requirements and throughout the whole lifecycle, whatever the nationality of the equipment maker. This study comes in the nick of time, when the FACS (Future Air Combat System) programme is presently beginning.**

**By courtesy of Air and Space Academy and DGLR, the Executive Summary of this document "Avis/Opinion" is here after reproduced.**

## EXECUTIVE SUMMARY

"Does it connect, does it share, does it learn?" is a question that should be asked of every owner of air and space combat assets in Europe. It is key to enabling collaborative air operations, which provide the best collective response to any threat despite the diversity of national means involved.

Indeed **collaboration**, involving access to the resources of all military assets to achieve a common objective, goes beyond **cooperation**, which only shares the results of some military assets to meet individual objectives.

Collaboration between assets allows for better sharing of onboard resources than simple cooperation. Increasingly, the value delivered by air and space systems comes from collaborative interactions that leverage individual capabilities: the sharing of data collection, storage and processing power allows operational services to be produced and distributed more quickly. Relevant intelligence and timely, secured orders can thus be promptly disseminated, enhancing overall European responsiveness.

Given the **heterogeneity** of European means and assets, and the proximity of potential threats as demonstrated in Ukraine, the success of European operations relies more and more on the ability to:

- network all military assets;
- move from limited cooperation to full collaboration, when mutually agreed.

Nevertheless, a greater openness to accommodate the diversity of assets creates a risk of **intrusion** by enemy forces that must also be addressed. The maximum collaboration level may therefore vary.

Appropriate organization is required to provide tactical agility and reactivity, and all stakeholders must be properly trained.

Of course, collaborative air and space combat operations will support **multi domain operations**[1] through data and information exchanges to deliver joint military action.

Nonetheless the **air and space** domains share some physical characteristics that deserve special attention in the development of collaborative capabilities:

- global reach and unimpeded communications facilitate the movement of material and data through an obstacle-free environment that can support theatrewide and multi-domain operations;
- limited in-flight resupply (fuel or weapons) necessitates robust collaborative logistics;
- the three-dimensional movements of air and space platforms result in a constantly 1 Air, space, cyber, land, naval plus information and electromagnetic spectrum. and rapidly evolving layout of the overall combat system, challenging connectivity.

This opinion paper proposes recommendations on issues that require specific attention in light of the above considerations.

Although the implementation of collaboration impacts humans, hardware and software, as well as their interfaces, we will focus on **digital aspects** that are particularly critical in air and space applications. It should be emphasized that some of these may already be taken care of within the EU or NATO environments. Our recommendations will address the various stages of the lifecycle of any procured military capability.

The **recommendations** are summarized below.

**R1 :** Enhance the current hardware-centric combat model with a data-centric combat model ("Software defined combat") taking advantage of the benefits of the aerospace environment to achieve local and temporary air and space superiority and support multi domain operations.

**R2:** Develop a complete set of operations according to foreseen scenarios and step down to each global actor: linking intelligence means with ground related assets, global and national Common operating pictures (COP), all current and future piloted aircraft (such as NGWS, Tempest-GCAP, NGAD...) and drones, working with respective national owners, allied armies and navies and special forces.

**R3:** Build, use and maintain a complete simulation lab, a "Digital Twin" adapted to all possible allied operations, in order to check the efficiency of all functions needed in each of the strategies envisaged.

**R4:** Draw up a list of requirements, technical specifications and standards for European air and space collaboration based on EU and NATO initiatives: dual by nature because they include links with non-military structures that can provide valuable data to defence services.

**R5:** When collecting information on European-based assets (for force generation or capability development), always list interfacing capabilities (technical and procedural) and assess them against the above requirements.

**R6:** Explore the possibility of a digital platform to manage air data exchanges (Data traffic management), capable of adapting to a variety of coalition situations. Establish relevant governance/decision-making principles for each operation.

**Red thread example**
*Use cases are recommended to illustrate the potential improvements of collaborative air and space combat operations.*
*The use case detailed hereafter is to detect and neutralize a convoy of long-range surfaceto-surface missiles moving from a storage location to a launch site at an unknown time, using contributions from air, space and ground players. It represents a persistent concern because success or failure has strategic implications.*

1 *Air, space, cyber, land, naval plus information and electromagnetic spectrum.*

# THE NEW ESA SPACE DEBRIS MITIGATION POLICY

By Paloma Villar and Francesca Letizia, ESA/ESTEC

**ACRONYMS**

| | |
|---|---|
| **CDF** | Concurrent Design Facility |
| **IADC** | Inter-Agency Debris Coordination Committee |
| **LEO** | Low Earth Orbit |
| **PMD** | Post-Mission Disposal |

For decades, there has been more space debris in orbit than operational satellites. In the recent years, we have been witnessing a significant change in the use of space, specifically in Low Earth Orbits (LEO). Launch rates are currently around 20 times higher than 20 years ago (Figure 1), which is when the Inter-Agency Debris Coordination Committee (IADC) published its Space Debris Mitigation Guidelines, the most widely internationally accepted document of this kind. Since then, not only the number of launches has changed over these years, but also the type of operator (with a switch towards commercial operators) and the typical size of spacecraft, with an evolution towards smaller platforms [1].

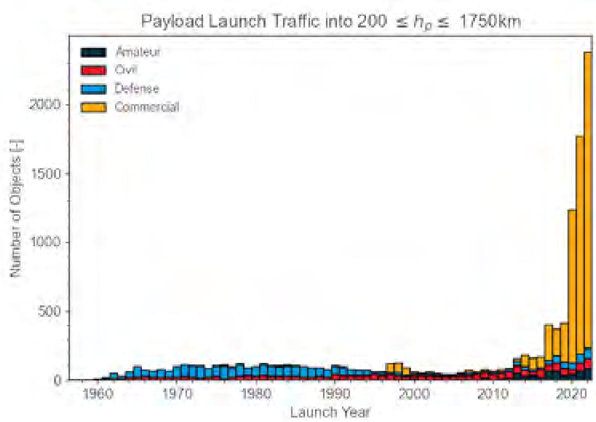



*Figure 1. Evolution of the launch traffic in Low Earth Orbit [1].*

In the most recent years, this change has been driven by the emergence of the so-called large constellations, which has prompted several studies into the assessment of how Space Debris Mitigation standards should evolve to limit the proliferation of debris in orbit. To understand this point, it is useful to refer to long-term simulations of the space debris environment, a tool often used in space debris modelling to quantify the sensitivity of the environment to parameters such as launch traffic, explosion rates, and mitigation approaches. Figure 2 shows an example of such analysis, based on the methodology in [2], where each colour represents a different scenario built considering traffic rates and initial populations at different epochs (2005, 2014, 2021, and 2022). In all cases, the mitigation option that is applied is the so-called "25-year rule" contained in the IADC guidelines i.e. spacecraft operating in LEO have to limit their permanence in orbit to 25 years after the end of their mission. One can see how the size of the population reached starting from the conditions in 2005 (i.e. around when the IADC guidelines were presented) is three times smaller than the one reached considering more recent initial conditions. This poses the question of whether the debris environment resulting from the application of the 25-year rule with the current launch traffic rates is still an acceptable one.

In addition, while traffic rates have grown so rapidly in the recent years, the level of adoption of mitigation mea-

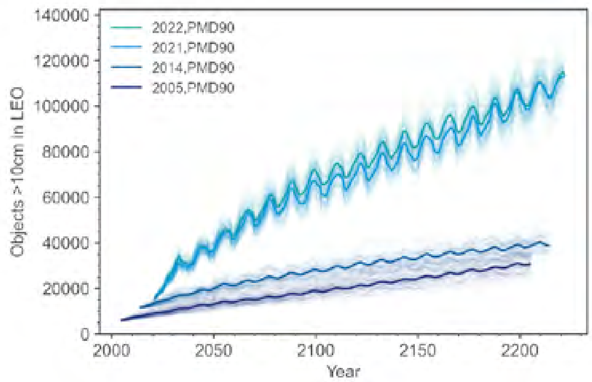



*Figure 2. Evolution of the number of objects larger than 10 cm in LEO according to ESA's DELTA model, considering traffic rates and initial populations at different epochs. PMD90 indicates that a 90% success rate for the implementation of the 25-year rule is assumed.*

sures against space debris (such as the already mentioned 25-year rule), has not grown with the same rate. ESA studies [1] show how the extrapolation of our current behaviour in the future may result in an exponential growth the number of objects in LEO, with the potential for some orbital regions of becoming unusable because of the high space debris density [3]. The studies also show that the population of objects would grow even in the case where all space activity (i.e. any future launch) would stop.

For these reasons, ESA has decided to introduce the so-called "Zero Debris" approach, whose goals are to significantly limit the production of debris in Earth and Lunar orbits by 2030 for all future missions, programmes and activities.

A first step in this direction is represented by a concurrent design facility study (Zero Debris CDF) [4] was held at the

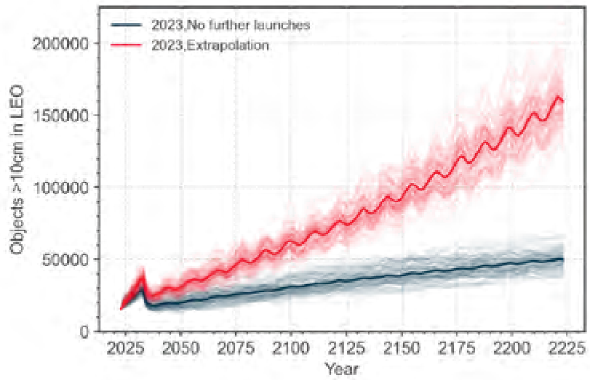



*Figure 3. Evolution of the number of objects larger than 10 cm in LEO according to ESA's DELTA model, in the two simulated scenarios [1].*

end of 2022 to draft a preliminary set of technical recommendations for the policy evolution. Such recommendations were based on an extensive simulation campaign [3] where the long-term evolution of the debris environment was analysed under different implementation options. The recommendations cover all aspects of a space mission, from design to operations, including proposals to strengthen orbital clearance requirements, recommend design-for-removal for high-risk mission, recognise best practices for collision avoidance, and mitigate the impact of missions on astronomy [5].

In 2023, ESA worked on the translation of such recommendations into is the update of ESA's Space Debris Mitigation Policy [6] and Requirements [7] applicable to ESA missions. This process took place through two working groups where more than 50 experts from all-over ESA were involved.
ESA's updated Space Debris Mitigation Policy defines role and responsibilities within the Agency for what concerns Space Debris Mitigation. It introduces a Space Debris Mitigation Assessment Board that will be in charge of providing recommendations to the Director General in case of requests for mission extensions or requests for waivers. The Policy document also clarifies the applicability of ESA's Space Debris Mitigation Requirements to all mission procured and operated by the Agency.
ESA's Space Debris Mitigation Requirements starts by adopting a common European baseline, as described by the ECSS requirements that have been applicable since 2014, and introduces additional requirements related to different aspects of a mission.

Firstly, in recognition of the fast-changing scenarios in space utilisation and evolving practices in space debris mitigation, this standard contains a set of requirements requesting specific analyses, but do not set a numerical value to comply to. The aim for these requirements is to:
- implement lessons learned from past and current missions,
- quantify, assess and document known risks,
- develop methodologies such that these requirements can adopt a numerical threshold in future versions of the standard.

A similar approach was observed in the evolution of the French Space Operation Act [8].
Secondly, ESA's Space Debris Mitigation Requirements introduce a risk classification based on two dimensions. Classically space debris mitigation measures have acted on the orbital lifetime (once inactive), as in the case of the 25-year rule, used as a proxy of the debris generation risk associated to a spacecraft (the longer in orbit, the higher the chances of being involved in a collision). This approach is maintained in the new standard, with increasingly stringent requirements for spacecraft with a lifetime in LEO longer than 5 or 25 years, and complemented with the consideration of the cumulative collision probability with space debris objects larger than 1 cm. This size is selected because collisions with objects of such dimension is considered to be potentially mis-

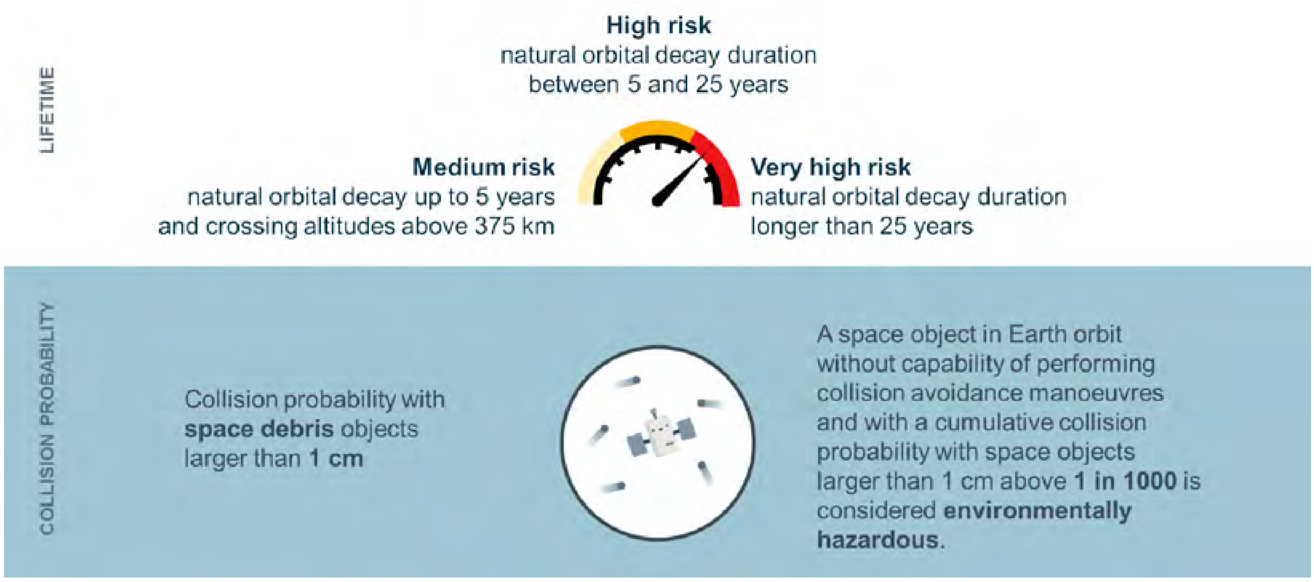



*Figure 4. Risk classification in ESA's Space Debris Mitigation Requirements.*

sion-terminating in several orbital regimes. For this reason, a space object in Earth orbit without capability of performing collision avoidance manoeuvres and with a cumulative collision probability with space objects larger than 1 cm above 1 in 1000 is considered environmentally hazardous, and also in this case more stringent requirements apply for this class of objects.
Thirdly, ESA's Space Debris Mitigation Requirements consider not only the so-called Protected Regions, i.e. LEO and GEO, which are the main focus of space debris mitigation measures, but also other orbital regions, with some requirements applicable to any Earth orbit (including Libration Point Orbits) and to Lunar orbits.

Finally, a classification of the space system type is also introduced, with stricter requirements for constellations (defined as missions with more than 10 satellites) and large constellations (missions with more than 100 satellites). Such requirements address topics such as collision risk management, passivation and de-orbit, casualty risk at re-entry.

In summary, among the most notable changes introduced by the new ESA's Space Debris Mitigation Requirements are:

- The duration of the disposal phase in Low Earth Orbit is reduced from 25 to a maximum of 5 years, or less, with an additional criterion based on the cumulative collision probability with space debris during the inactive phase, and more stringent requirements for constellations;
- The probability of successful disposal shall be larger than 90% considering both internal (reliability) and external (impacts) factors, with more stringent requirements for large constellations;
- Space objects operating in the protected regions, which are not considered to be at low risk, shall be "prepared for removal", i.e. present interfaces to facilitate the servicing by an active debris removal mission in case they would fail in orbit;
- A set of new requirements on the topic of collision avoidance and space traffic coordination is introduced to codify current best practices, such as a maximum collision probability threshold and related operational aspects, such as, e.g., a response times in case of warnings;
- The two emerging issues of avoiding space debris proliferation in Lunar orbits and interference to radio and optical astronomy are also addressed with a preliminary set of requirements to be furthered matured in the next years.

By adopting these novel requirements for its own missions, ESA aims at assuming a global leading role in space sustainability and at paving the way for a space debris neutral future. As part of these efforts, ESA has also facilitated the preparation of a "Zero Debris Charter" [9] - a global initiative for all space entities to sign and follow towards the shared goal of a Zero Debris future. The "Zero Debris Charter", which has opened at the Space Summit 2023 for signatories, has the aim of shaping the global consensus on space sustainability, by gathering a wide and varied array of space entities to define ambitious and measurable space debris mitigation and remediation targets for 2030.

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# ARIANE 6 JOINT UPDATE REPORT

18 December 2023

***The Ariane 6 Launcher Task Force consists of top management of ESA, as the overall Ariane 6 procuring entity and launch system architect, of the French Space Agency CNES, as the launch base prime contractor, of ArianeGroup as the launcher system prime contractor and of Arianespace as the launch service provider. This group reports regularly on progress being made towards inaugural flight of the new Ariane 6 launcher.***

**KEY MILESTONES TOWARDS INAUGURAL FLIGHT:**
On the way towards the first flight of Ariane 6, two more rehearsals have been conducted since the last joint update.

**15 December 2023: Combined test loading 3 (CTLO3), Kourou, French Guiana**
On 15 December, 2023, teams from ArianeGroup, the French Space Agency (CNES), and the European Space Agency (ESA) successfully carried out another launch sequence of Ariane 6 on its launch pad at Europe's Spaceport, French Guiana, for the combined test campaign.

The combined test loading (CTLO3) tested a launch countdown aimed to qualify the launch system in degraded conditions to ensure its robustness and prepare for operations. It was run the same way as the previous ones, with a launch sequence and final countdown representative of a launch, including removal of the mobile gantry as well as filling and draining of the launcher's upper and core stage tanks with liquid hydrogen (-253 °C) and liquid oxygen (-183 °C). This test sequence included qualification tests of several launch system functions in case of aborted launch and included one ignition of the Vulcain 2.1 engine thrust chamber.
This was the fifth countdown run to include loading Ariane 6 with cryo-propellants since July.
The rehearsal was very well executed, and the countdown ran exactly as planned. The test was a full success and the task force thanks all teams involved.
The launch operations for Ariane 6 are mastered, we are ready to go.

**7 December 2023: Upper stage firing test, Lampoldshausen, Germany**
Having already qualified for flight after rigorous tests under routine conditions, Ariane 6's upper stage was pushed to its limits last week. The goal of the hot-fire test (HFT-4) on 7 December at the German Aerospace Center (DLR) test facility in Lampoldshausen, Germany, was to reproduce a normal start of a flight with the restartable Vinci engine and Auxiliary Power Unit (APU), and then to introduce degraded conditions to assess the robustness of the stage and how it would behave in extreme and unexpected conditions.

Two minutes after the Vinci engine and APU were fired up, the test was automatically aborted when sensors detected that some parameters had gone beyond predetermined thresholds. The engines were shut down with the nominal sequence, the upper stage test model and test bench entered a safe condition, and the tanks were emptied.
This HFT-4 test went beyond the normal flight profile for Ariane 6. The stage will not operate in such a test configuration on the inaugural flight. Teams are analysing test hardware and investigating possible root causes of the abort, with results expected mid-January 2024. More details will be given after the next Task Force meeting. We are confident that these investigations will not impact the schedule to Ariane 6 inaugural flight.

**NEXT MILESTONES:**
**End January 2024: disconnection tests of the cryo-connection system**
A rehearsal of disconnecting the upper and lower fuelling arms that support the umbilicals that supply Ariane 6 with liquid hydrogen and oxygen. The same umbilicals allow the propellant to be drained safely if a launch is aborted.

**Mid-February: Arrival of first flight elements in French Guiana**
The stages for the first Ariane 6 flight will arrive by Canopée ship in French Guiana.

**First flight period**
ESA, CNES and ArianeGroup are targeting the first launch of Ariane 6 (in A 62 configuration) between mid June and end of July 2024.

*Ariane 6 is an all-new design, created to succeed Ariane 5 as Europe's heavy-lift launch system. With Ariane 6's upper stage restart capability, Europe's launch capability will be tailored to the needs of multiple payload missions, for example to orbit satellite constellations. This autonomous capability to reach Earth orbit and deep space supports Europe's navigation, Earth observation, scientific and security programmes. Ongoing development of Europe's space transportation capabilities is made possible by the sustained dedication of thousands of talented people working in ESA's 22 Member States.*

# ARIANE 6: FACTS AND KEY-FIGURES

*Illustration of the two Ariane 6 variants planned, A62 (left) and A64 (right)*

| | |
|---|---|
| **Function** | Medium-heavy launch vehicle |
| **Manufacturer** | ArianeGroup |
| **Country of origin** | European Space Agency |
| **Project cost** | €3.6 billion[1] |
| **Cost per launch** | €75 million (Ariane 62)<br>€115 million (Ariane 64)[2][3] |

### SIZE

| | |
|---|---|
| **Height** | 63 m (207 ft) |
| **Diameter** | 5.4 m (18 ft) |
| **Mass** | 530–860 t (520–850 long tons; 580–950 short tons) |
| **Stages** | 2 |

### CAPACITY

| | |
|---|---|
| **Payload to LEO** | |
| **Mass** | A64: 21,650 kg (47,730 lb)<br>A62: 10,350 kg (22,820 lb)[4] |
| **Payload to GTO** | |
| **Orbital inclination** | 6˚ |
| **Mass** | A64: 11,500 kg (25,400 lb)<br>A62: 4,500 kg (9,900 lb)[4] |
| **Payload to GEO** | |
| **Orbital inclination** | 0˚ |
| **Mass** | A64: 5,000 kg (11,000 lb)[4] |
| **Payload to SSO** | |
| **Orbital inclination** | 97.4˚ |
| **Mass** | A64: 15,500 kg (34,200 lb)<br>A62: 7,200 kg (15,900 lb)[4] |
| **Payload to LTO** | |
| **Mass** | A64: 8,600 kg (19,000 lb)<br>A62: 3,500 kg (7,700 lb)[4] |

### ASSOCIATED ROCKETS

| | |
|---|---|
| **Family** | Ariane |
| **Comparable** | Vulcan Centaur, H3, Titan IV, Falcon 9, Falcon Heavy (reusable) |

### LAUNCH HISTORY

| | |
|---|---|
| **Status** | In Development |
| **Launch sites** | Centre Spatial Guyanais |
| **First flight** | 15 June - 31 July 2024 (planned)[5] |

### BOOSTERS – EQUIPPED SOLID ROCKET

| | |
|---|---|
| **No. boosters** | 2 or 4 |
| **Diameter** | 3 m (9.8 ft) |
| **Propellant mass** | 142,000 kg (313,000 lb) |
| **Powered by** | P120 |
| **Maximum thrust** | 4,650 kN (1,050,000 lbf) each |

### CORE STAGE – LOWER LIQUID PROPULSION MODULE

| | |
|---|---|
| **Diameter** | 5.4 m (18 ft) |
| **Propellant mass** | 140,000 kg (310,000 lb) |
| **Powered by** | Vulcain 2.1 |
| **Maximum thrust** | 1,370 kN (310,000 lbf) |
| **Propellant** | LH2 / LOX |

### UPPER STAGE – UPPER LIQUID PROPULSION MODULE

| | |
|---|---|
| **Diameter** | 5.4 m (18 ft) |
| **Propellant mass** | 31,000 kg (68,000 lb) |
| **Powered by** | Vinci |
| **Maximum thrust** | 180 kN (40,000 lbf) |
| **Propellant** | LH2 / LOX |

# SpaceX's SECOND LAUNCH TEST

**The second Starship mission lifted off on Saturday 18 November 2023 at 13:00 GMT from Space's Starbase site in South Texas. It aimed at sending Starship's upper stage most of the way around Earth, wrapping up with a splashdown in the Pacific Ocean near Hawaii 90 minutes after launch.**

**But the flight ended about 8 minutes in, with a "rapid unscheduled disassembly" of the craft.**
**In addition, Starsip's huge Super Heavy stage, which was supposed to come back to Earth 7 minutes after liftoff, broke apart high in the sky just after separating from the upper stage.**

**So, Starship did not notch some important milestones on this flight test number two, BUT:**

1. **– the stage separation was successful, which did not occur on the vehicle's first test flight in past April:**
2. **– all of the 33 Super Heavy's Raptor engines burnt for the proper duration, which had not been the case during the first test in April.**
3. **– Just after stage separation and the booster's explosion after its beginning its boostback, the Starship second stage continued to fly nominally for over 8 minutes, reaching space at the altitude of 148 km (speed = ) before explosion;**
4. **– Starbase's orbital launch mount seemed to emerge unscathed.**

**So, given the progress made with flight two compared to flight one, flight test three should take place in the coming months.**

## LIVE STARSHIP TEST FLIGHT NUMER TWO: 18 NOVEMBER 2023

**> Vidéo**

> Click to the picture to see the video

## THE MAIN STEPS OF THE FLIGHT

**Just before launch**

*Illustration 1*
*A View of Starship and its Supper heavy Booster on the launch pad at Starbase in Boca China, Texas just before launch. (Image credit SpaceX)*

**Epic 33-engine burn**

All 33 Raptor engines on the Super Heavy Booster started up successfully, and for the first time, completed a full-duration burn during ascent. The fact that all 33 engines fired simultaneously all the through a full burn is an historic first.

*Illustration 2*
*SpaceX's giant Starship rocket launched on its second-ever test flight on Nov. 18, 2023, igniting all 33 of its first-stage Raptor engines in unison for lift-off. 'Image credit: SpaceX)*

**Beginning of ascent**

*Illustration 3 - The ascent f Starship © Space X*

**Stage separation**

*Illustration 4 -*
*Stage separation a key milestones of SpaceX's 2nd flight test and Super Heavy occurred 2.5 minutes after launch (Image credit SpaceX)*

**First explosion**

Possibly the automated flight termination system at second stage has triggered very late in the burn as the vehicle was headed downrange out over the Gulf of Mexico,

*Illustration 5 - © Space X*
*SpaceX's giant Starship super Heavy booster exploded shortly after separation from the upper stage in a "rapid unscheduled disassembly". (Image credit SpaceX)*

**End of the flight – second explosion**

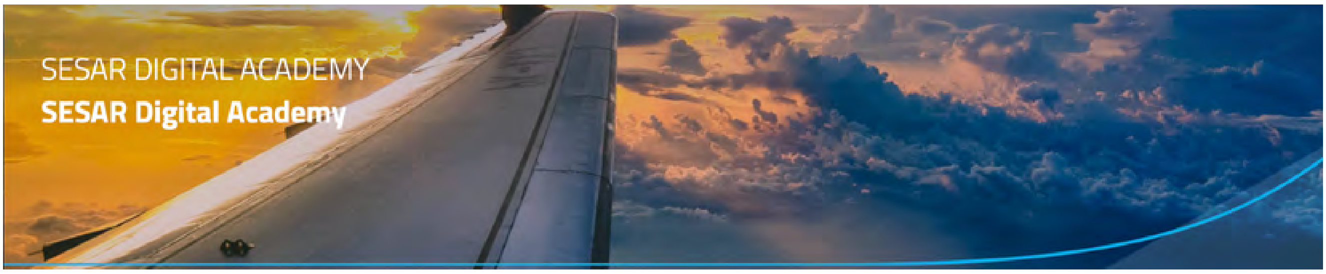
*Illustration 6 - © SpaceX*
*Boom*

## ONWORD TO THE MOON

**NASA now plans as follows :**

- **September 2025 Artemis II, the first crewed mission around the Moon**
- **September 2026 Artemis III with the first landing of astronauts near the lunar South pole**
- **2028 first mission to the Lunar Space Station (LSS Gateway.**

# SESAR DIGITAL ACADEMY




## OVERVIEW

With its exploratory research programme, the SESAR Joint Undertaking (SESAR JU) has progressively embedded activities aimed at developing the skills of the future air traffic management (ATM) workforce. These have provided opportunities for students to participate and contribute to ATM research in Europe, including support for PhD research projects.

In 2017, Violeta Bulc, Commissioner for Transport, addressed the SESAR Innovation Days, noting the role of SESAR in nurturing the aviation talent of tomorrow and in developing new ideas to ensure greater mobility and connectivity through air travel in Europe.

In her address, she encouraged the SESAR JU to consider creating a "SESAR Academy", in order to skill and inspire the next generation aviation workforce in anticipation of the digital economy. Her words underscore the SESAR JU's recognised role of stimulating, funding and coordinating all research related to ATM across Europe.

The creation of the SESAR Digital Academy has the ambition to ensure the sustainability of the knowledge gained beyond the duration of individual research projects.

## VISION AND MISSION

The vision of the SESAR Digital Academy is to become a recognised learning initiative supporting Europe's future aviation and ATM workforce.  The mission is to nurture Europe's brightest minds and advance learning, scientific excellence and innovation in aviation and ATM.

The Academy aims to promote student mobility and a whole spectrum of learning opportunities, from fundamental research to industry-focussed applied research, and to enhance the knowledge, skills and employability of aviation professionals.

The SESAR Digital Academy seeks to bring together under one umbrella access to SESAR exploratory research activities and outreach relating to education and training, as well as professional learning opportunities offered by research centres, universities, industry partners and other entities within the ATM/aviation domain.

## PARTICIPANTS AND BENEFICIARIES

The digital academy is an open initiative with a wide range of participants and beneficiaries:

- Students and Academia
- Research institutes
- Industry
- Standardisation, regulatory and safety authorities

The mission and vision of the SESAR Digital Academy are complementary to those of existing aviation/aeronautics interest groups, associations and networks at European level. The academy will seek to identify synergies and potential for collaboration as part of its plan of activities.

## ACTIVITIES

**Digital Academy e-news**

Regular e-News providing the latest on activities and opportunities provided by the academy.

**Read here our first enews** targetted towards the academic community. To be added to this specific mailing list, complete the form below.

**SESAR Digital Academy Webinars**

As air travel tentatively resumes, the move to digitalised ATM infrastructure is seen as critical for making aviation more scalable, economically sustainable, environmentally efficient, predictable and resilient.

Against this backdrop, the SJU, under the umbrella of the SESAR Digital Academy, is organising a series of webinars to present the portfolio of SESAR innovations that will make this digital transformation possible.

Find out about upcoming webinars or watch playbacks of previous recordings here: https://www.sesarju.eu/webinars

## CONTACT

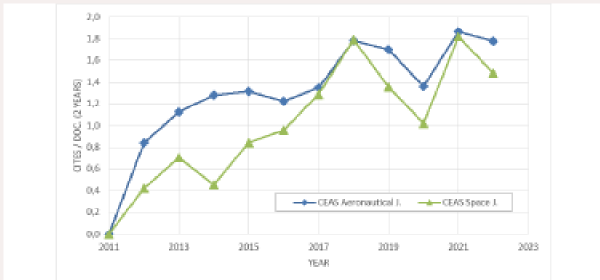
Want to contact us ? Drop us an email at:
info@sesaracademy.eu or complete the form below.

# 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.

**The Managing Editors:**
- Andrea Dieball
- Cornelia Hillenherms
- Wilhelm Kordulla
- Stefan Leuko
- Johan Steelant

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## CEAS SPACE JOURNAL


**Volume 15, Issue 6, November 2023**

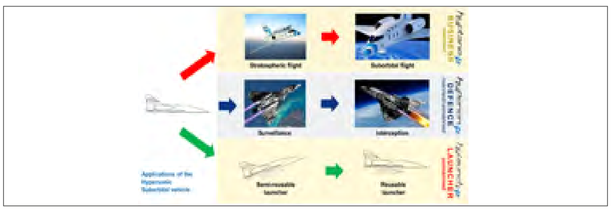
**Special Issue on High-Speed Vehicle Systems and Technologies**

### HIGH-SPEED VEHICLE SYSTEMS AND TECHNOLOGIES

**A. Siebenhaar, L. Chen, C. Fureby, A. Gernoth, M. Marini, J. Steelant, R. Vetrano & V. Wheatley** / Published online: 12 October 2022 (Editorial)

### HYPLANE: A SINGLE-STAGE SUBORBITAL AEROSPACEPLANE

**G. Russo & C. Voto** / Published online: 15 April 2023



### SYSTEMATIC ASSESSMENT OF SPACELINER PASSENGER CABIN EMERGENCY SEPARATION USING MULTI-BODY SIMULATIONS

**M. Sippel, S. Stappert, Y. M. Bayrak & L. Bussler** / Published online: 02 June 2023 (Open Access)

### DESIGN OPTIMIZATION OF MULTI-FUNCTIONAL MULTI-LOBE CRYOGENIC FUEL TANK STRUCTURES FOR HYPERSONIC VEHICLES

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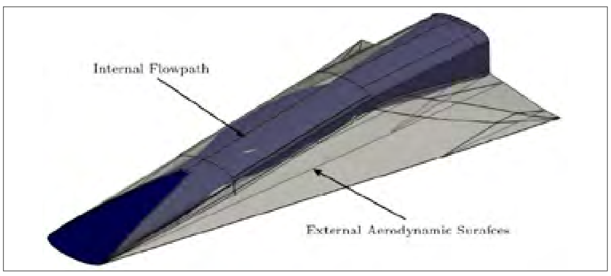
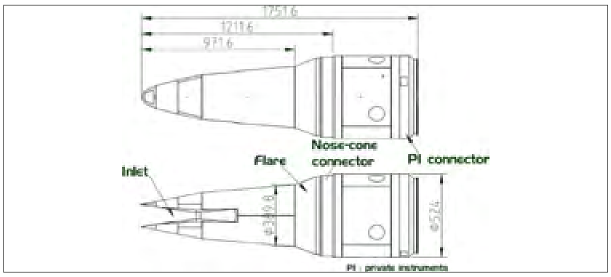


## [COMBUSTION CHARACTERISTICS OF A SUPERSONIC COMBUSTOR MODEL FOR A JAXA FLIGHT EXPERIMENT]

**M. Takahashi & K. Kobayashi & S. Tomioka**/ Published online: 15 May 2023 (Open Access)

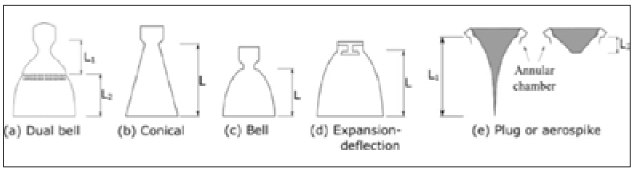



## REACTION MECHANISM REDUCTION FOR ETHYLENE-FUELED SUPERSONIC COMBUSTION CFD

**K. Kobayashi, S. Tomioka, M. Takahashi & M. Kodera** / Published online: 27 February 2023 (Open Access)

## A SHAPE DESIGN OPTIMIZATION METHODOLOGY BASED ON THE METHOD OF CHARACTERISTICS FOR ROCKET NOZZLES

**T. Fernandes, A. Souza & F. Afonso** / Published online: 08 July 2023 (Open Access)




## ANALYSIS OF WEATHER BALLOON DATA TO EVALUATE THE AERODYNAMIC INFLUENCE ON THE LAUNCH PHASE OF SHEFEX II

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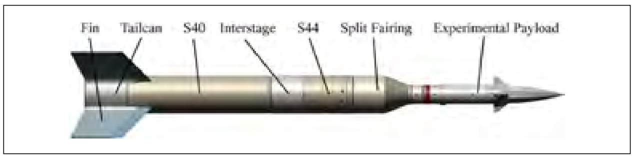
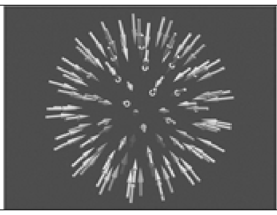



## APPROXIMATION MODELS FOR DRAG AND HEAT FLUX OF RANDOM TUMBLING OBJECTS IN THE TRANSITIONAL REGIME

**P. van Hauwaert** / Published online: 03 April 2023



## AN ANALYSIS TOOL FOR BOUNDARY LAYER AND CORRELATION-BASED TRANSITION ONSET ASSESSMENT ON GENERIC GEOMETRIES

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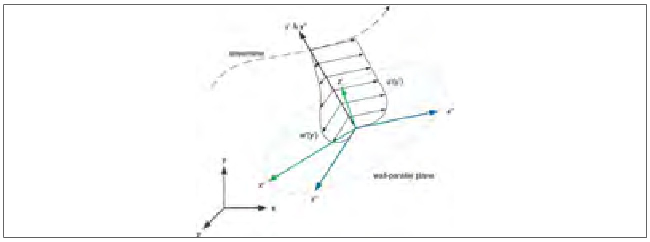

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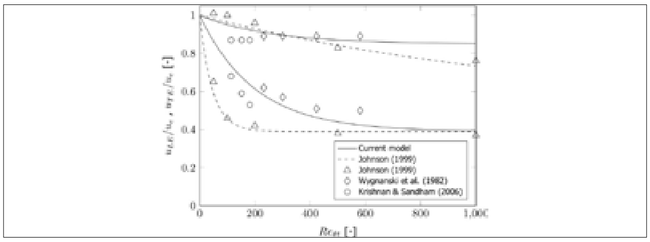


## OCTRA AS ULTRASONICALLY ABSORPTIVE THERMAL PROTECTION MATERIAL FOR HYPERSONIC TRANSITION SUPPRESSION

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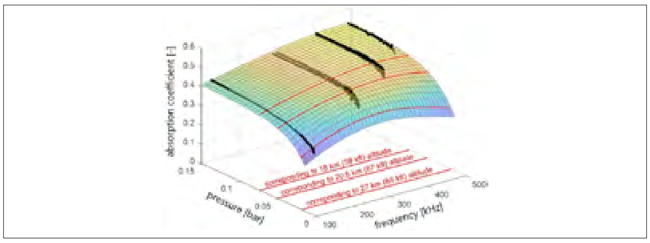

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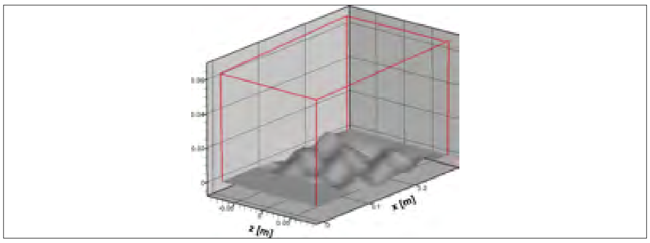


## OUTCOME OF HIGH-SPEED BOUNDARY LAYER TRANSITION WORKSHOP AT HISST 2022

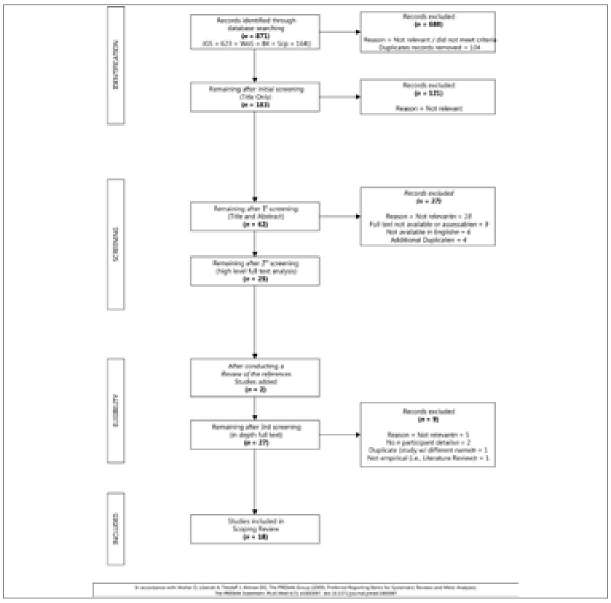
**N. Sandham & J. van den Eynde** / Published online: 12 May 2023 (Short Communication)

## CEAS AERONAUTICAL JOURNAL


**Volume 14, Issue 4,
October 2023**

### EXTENDED REALITY (XR) FLIGHT SIMULATORS AS AN ADJUNCT TO TRADITIONAL FLIGHT TRAINING METHODS: A SCOPING REVIEW

**Glen Ross & Andrew Gilbey** / Published: 20 October 2023 (Open Access)



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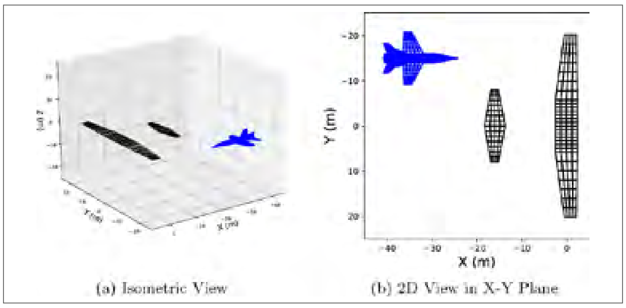
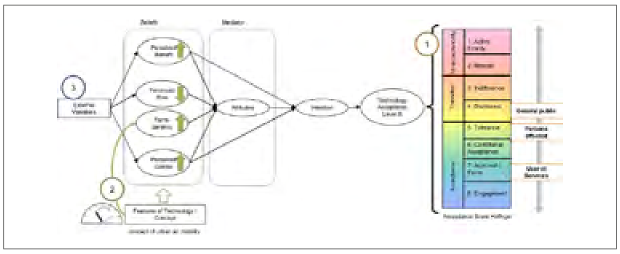


(a) Isometric View (b) 2D View in X-Y Plane

### A MIXED-METHOD APPROACH TO INVESTIGATE THE PUBLIC ACCEPTANCE OF DRONES

**Maria Stolz, Anne Papenfuss, Georgia Cesar de Albuquerque Richers, Anna Bahnmüller, Azeem Muhammad Syed, Andreas Gerndt, Martin Fischer, Jan Wegener, Teemu Joonas Lieb & Marcus Biella** / Published: 16 November 2023 (Open Access)



### CONCEPTUAL DESIGN OF A MIDDLE-OF-THE-MARKET AIRLINER

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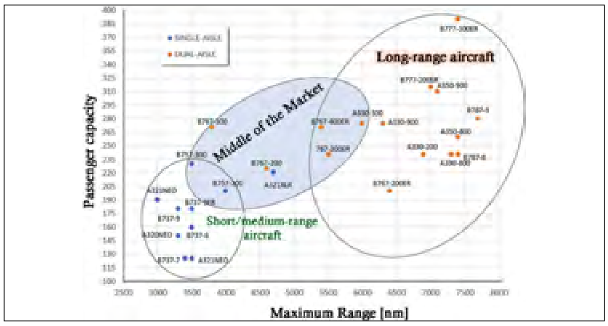


### LIQUID HYDROGEN STORAGE DESIGN TRADES FOR A SHORT-RANGE AIRCRAFT CONCEPT

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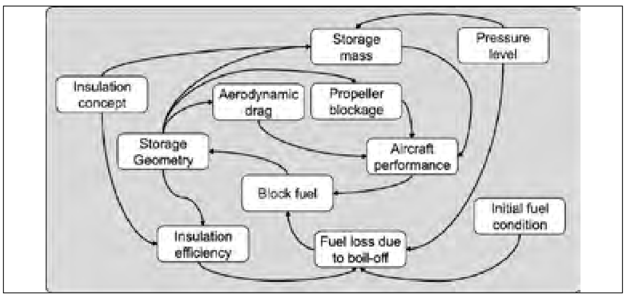

## [MODEL-BASED DESIGN AND MULTIDISCIPLINARY OPTIMIZATION OF COMPLEX SYSTEM ARCHITECTURES IN THE AIRCRAFT CABIN]

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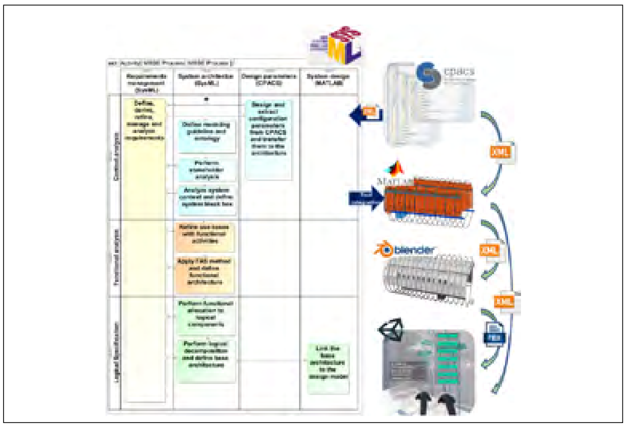


## OVERVIEW OF CRITERIA TO ESTIMATE AERODYNAMIC LIMITS OF THE FLIGHT ENVELOPE OF A TRANSONIC AIRCRAFT BASED ON RANS SIMULATIONS

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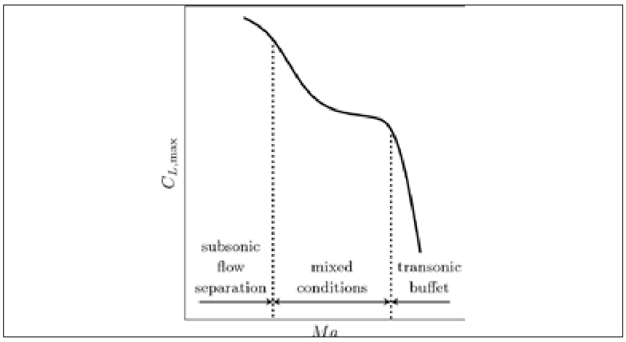


## EXPERIMENTAL AND NUMERICAL ANALYSIS OF THE AERODYNAMICS AND VORTEX INTERACTIONS ON MULTI-SWEPT DELTA WINGS

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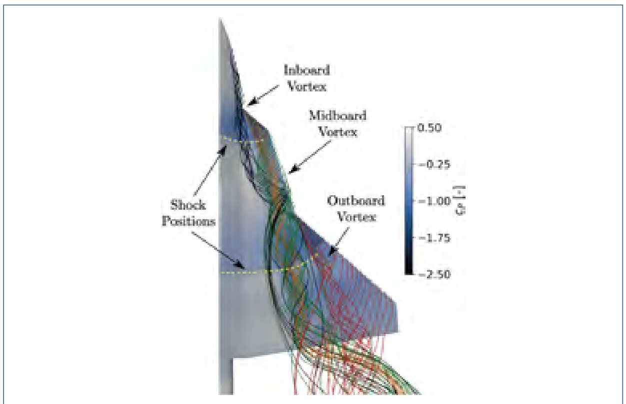


## NUMERICAL INVESTIGATION OF A COANDĂ-BASED FLUIDIC THRUST VECTORING SYSTEM FOR SUBSONIC NOZZLES

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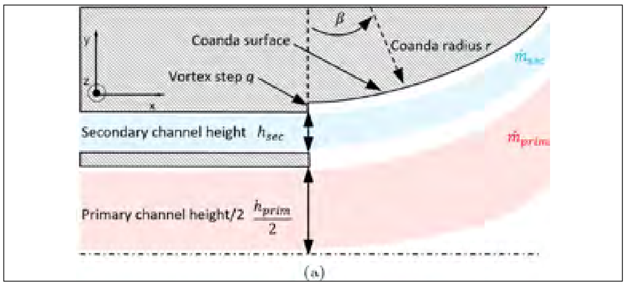


## HIGH-RESOLUTION VIBROACOUSTIC CHARACTERIZATION OF DLR'S FALCON 2000LX ISTAR AIRCRAFT

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## A CONTRIBUTION TO THE INVESTIGATION OF ACOUSTIC INTERFERENCES IN AIRCRAFT DISTRIBUTED PROPULSION

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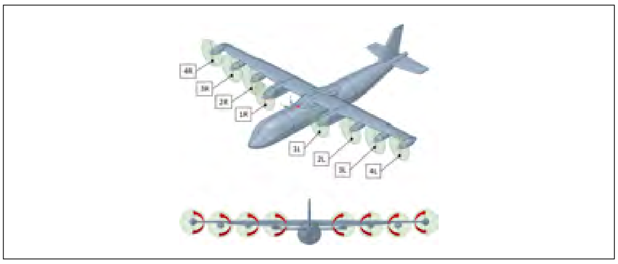

## HOLISTIC PERFORMANCE EVALUATION OF A TURBOFAN FEATURING PRESSURE GAIN COMBUSTION FOR A SHORT-RANGE MISSION

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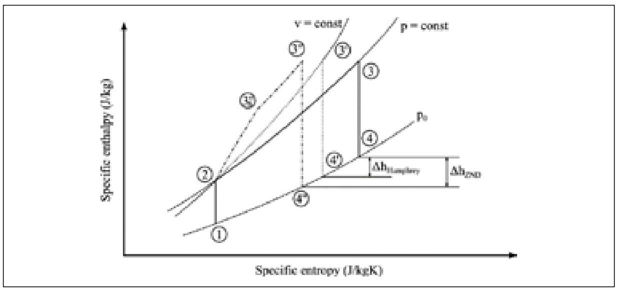
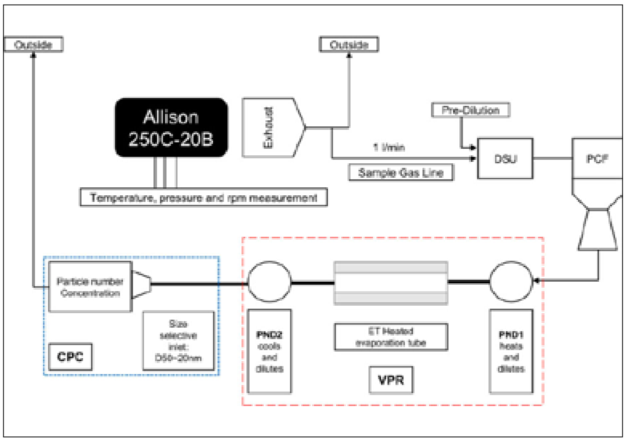


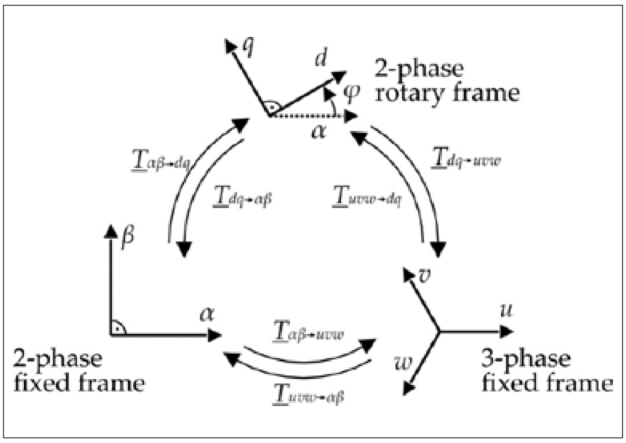
## [EXPERIMENTAL INVESTIGATION OF PERFORMANCE AND SOOT EMISSIONS OF OXYGENATED FUEL BLENDS IN A SMALL AERO ENGINE]

**Alexander Rabl, Christopher Mull, Martin Härtl, Christian Helcig & Volker Gümmer** / Published: 07 November 2023 (Open Access)



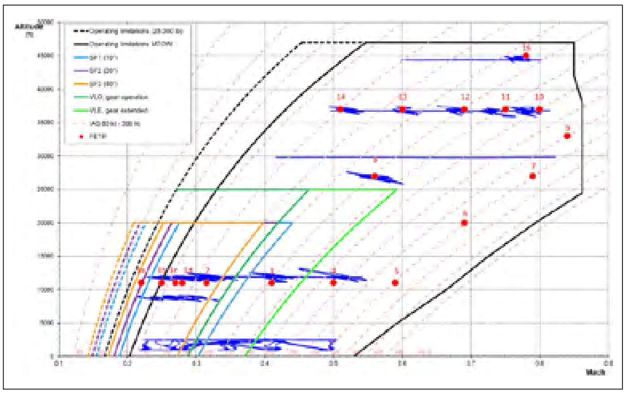

## SENSORLESS MOTOR CONTROL FOR ELECTROMECHANICAL FLIGHT CONTROL ACTUATORS

**Robert Kowalski & Patrick Juchmann** / Published: 25 September 2023 (Open Access)



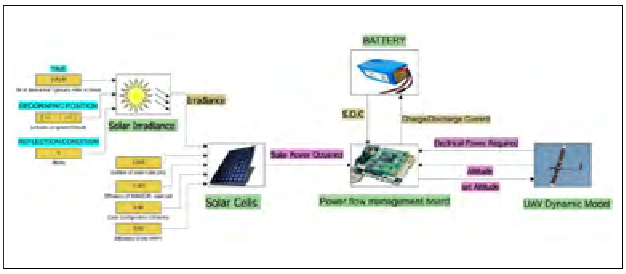

## PRACTICAL EXAMPLES FOR THE FLIGHT DATA COMPATIBILITY CHECK

**Christian Raab** / Published: 11 October 2023 (Open Access)



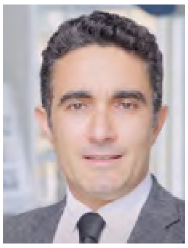

## REAL-TIME POWER FLOW ANALYSIS AND MANAGEMENT FOR A LONG-ENDURANCE SOLAR UAV DURING CONTINUOUS FLIGHT

**Nourddine Ghelem, Djamel Boudana & Ouahid Bouchhida** / Published: 05 October 2023



# $56^{TH}$ CEAS BOARD OF TRUSTEES AND ANNUAL GENERAL ASSEMBLY

**By Andrea Alaimo, DG of CEAS**



*Andrea Alaimo, DG of CEAS*

**The $56^{th}$ CEAS Board of Trustees and the annual General Assembly** were held in Brussels the $30^{th}$ of November 2023, hosted by DLR in the Istitutional CEAS headquarter. During the meeting, the Trustees has firstly confirmed the admission of Von Karman Institute for Fluid Dynamics as a new CEAS Corporate Member, who elected Mr Christophe Schram as representative person. As already discussed in July, the Von Karman Institute for Fluid Dynamics has confirmed the intention to host the AIAA/CEAS Aeroacoustic conference for 2026, proposal that was positively received by the Trustees.

CEAS Conferences represented one of the main topic of the meetings. The board has in fact firstly approved the AIDAA proposal, presented by prof. Erasmo Carrera, for the organization of the AEC 2025 in Turin. Then, the progress of the organizational activities of the CEAS conferences for 2024 was analyzed and discussed. 2024 will be, in fact, a year full of CEAS Conferences starting with the $3^{rd}$ International Conference on High Speed Vehicle Science and Technology HiSST that will be held in Busan, South Korea 14 – 19 April 2024. The list of CEAS Conference for 2024 continues with the 30th AIAA/CEAS Aeroacoustics Conference to be held in Rome 4 – 7 June 2024, EuroGNC (Guidance Navigation and Control) to be held in Bristol UK, 12-14 June 2024, $20^{th}$ IFASD (Int Forum on Aeroelasticity and Structural Dynamics) to be held in The Hague, Netherlands 17 – 21 June 2024 and the $50^{th}$ European Rotorcraft Forum to be held in Marseille, France 10 -12 Sept 2024.

Lastly but not least, the CEAS board of Officer was re-elected with the confirmation of the 3 Vice-Presidents, Ms Cornelia Hillenherms as Vice-President Finance, Mr Anders Blom as Vice-President Awards & Membership, Mr Łukasz Kiszkowiak as Vice-President External Relations & Publications and the re-election of Mr Franco Bernelli Zazzera as CEAS President for one more year.

# 2024

## AMONG UPCOMING AEROSPACE EVENTS

## JANUARY

**08-12** January– AIAA – **AIAA SciTech Forum** – Orlando, FL (USA) – https://www.aiaa.org/SciTech

**18-19** January– ESA – **Space for Inspiration 2024** – Noordwijk (NL) – ESA/ESTEC – https://atpi.eventsair.com/esamed/list-of-events

**23-25** January– 3AF – **OPTRO 2024** – 11th international Symposium on Optronics in Defence and Security - Bordeaux (France) – https://www.3af-optro.com

**31** January -**01** February – EUROCONTROL – **EUROCONTROL Network Manager Forum 2024** – Dedicated to Aviation Operational Community – Brussels (Belgium) – EUROCONTROL/HQ – https://www.eurontrol.int/events

## FEBRUARY

**12-14** February– ESA – **HAPS4ESA – 4th High Altitude Pseudo Satellites Conference** – Leiden (NL) – Event & Convention Centre - https://atpi.eventsair.com/

**14-15** February– ASCENDxTexas –**Conference Next Steps in the LEO-to-Lunar Voyage** – Houston , TX (USA) – South Shore Harbour Resort and Conference Center – www.aiaa.org/events/

**20-25** February– Singapore – **Singapore Air Show 2024** – Singapore – Singapore Exhibition Center Singapore – https://www.singaporeairshow.com/

## MARCH

**02-09** March – IEEE – **IEEE Aerospace Conference** – Laurel, MD (USA) – www.aeroconf.org

**05-06** March – CAJU – **Clean Aviation Annual Forum** – Charting the Skies of Tomorrow – The Sustainable Aviation Revolution – Brussels (Belgium) – Docks Dome Eventhall - https://www.clean-aviation.eu/clean-aviation-forum-2024

**06-08** March – ERCOFTAC – **Machine Learning for Fluids Dynamics** – Paris (France) – Campus of Sorbonne University – https://www.ercoftac.org/events/

**12-13** March – RAeS – **ESSI – RAeS Conference: Leading Global Change through the Earth & Space Sustainability Initiative** – London (UK ) – RAeS/HQ – https://www.aerosociety.com/events/

**12-14** March – ICAO – **INNOVATION FAIR 2024** – Digital Aviation: the future is now – Montréal (Canada) – ICAO/HQ – https://www.icao.int/meetings

**27-29** March – 3AF – **58th 3AF International Conference on Applied Aerodynamics** – Emerging approaches – Orléans (France) – https://www.3af.org – https://www.aerodynamics.com

## APRIL

**10-12** April – ERCOFTAC – **DLES14 – Direct Large Eddy Simulation** – Erlangen (Germany) – https://www.ercoftac.org/events/

**14-19** April – ESA – **HiSST 2024 – 3rd International Conference on High-Speed Vehicle and Technology** – Busan (South Korea) – https://www.hisst2024.org

**15-18** April – ESA – **SESARJU/DLR – TRA2024** – Transport Research Arena – Transport Transitions: Advancing Sustainable and Inclusive Mobility – Dublin (Ireland) – https://www.sesarju.eu/events

**17-19** April – RAeS – **International Conference on Energy from Space** – Potential of Space-based Solar Power (SBSP) to be unlocked – London (UK) – RAeS/HQ – https://www.aerosociety/events/

**17-20** April – Aero Friedrichhafen – **The leading show for General Aviation** – 30th Anniversary – Friedrichhafen (Germany) – https://www.aeroexpo.de

**29-30** April – EUROCONTROL – **FLY AI Forum 2024** – 2nd Edition: How is AI shaping aviation? Brussels (Belgium) – EUROCONTROL/HQ – https://www.eurocontrol.int/events

**29** April - **01** May – ASME – **ASME's 2nd Annual Aerospace Structures, Structural Dynamic and Materials Conference** – Seatle, WA (USA) – Hyatt Regency Lake Washington Renton, WA – Seatle's South Airport – https://event.asme.org/SSDM

**30** April - **01** May – FSF – **BASS 2024** – Business Aviation Safety Summit – Austin, TX (USA) – Austin Marriot Downtown – https://flightsafety.swoogo.com/BASS2024

**30** April - **02** May – ICAO – **ICAO Global Implementation Support 2024** – Punta Cana (Dominican Republic) – Bavaro Convention center – https://www.icao.int/meetings

## MAY

**8-10** May – IAA – **4th IAA Conference on Space Situational Awareness** – ICSSA – Dayton Beach, FL (USA) – https://iaaspace.org/event

**19-23** May – ESA/SSO – **26th ESA Rocket & Balloon Symposium** – Lucerne (Switzerland ) – Hochschule Luzern HSLU – https://atpi.eventsair.com/

## AMONG UPCOMING AEROSPACE EVENTS

**21-23** May – RAeS – **RAeS Future Combat Air and Space Capabilities Summit 2024** – Updated assessment on the strategic direction of air and space capabilities in the UK and beyond – London (UK) – RAeS/HQ – https://www.aerosociety/events/

**27-31** May – CNES/ESA – **4S Symposium** – Small Satellites Systems and Services Symposium – Space Transformation – Palma de Mallorca ( Spain) – https://atpi.eventsair.com/

**28-30** May – NBAA/EBAA – **EBACE 2024** – European Business Aviation Convention & Exhibition – Europe's premier business aviation event – Geneva (Switzerland) – https://ebace.aero/2024/about

**29-31** May – EUROMECH – **EMMC19 – 19th European Mechanics of Materials Conference** – Madrid (Spain) – https://euromech.org/

### JUNE

**03-07** June – ECCOMAS – **ECCOMAS2024 – 9th European Congress on Computational Methods in Applied Sciences and Engineering** – Lisbon (Portugal) – https://www.eccomas.org/

**04-07** June – AIAA/CEAS – **Aeroacoustics 2024 – The 30th AIAA/CEAS Aeroacoustics Conference** – Rome (Italy) – https://www.aidaa.it/2023/01/18/aiaa-ceas-aeroacoustics-conference/

**05-09** June – BDLI – **ILA 2024 Berlin Air Show – Berlin ExpoCenter Airport** – Schönefelt Airport - https://www.ila-berlin.de

**11-13** June – CANSO/ATCA – **Global ATM Summit and 28th AGM** – Baku (Azerbaidjan) – https://canso.org/event/

**11-13** June – 3AF/EST – **ETTC 2024** – European Test and Telemetry Conference – Next steps in sustainable testing in challenging environments for all transport sectors ( air, ground, space and maritime). Nuremberg (Germany). NümbergMesse GmbH – https://www.telemetry-europe.org/ettc-2024/conference/ - (EST European Society of Telemetry)

**12-14** June – CEAS/RAeS – **EuroGNC2024** – Bristol (UK) – University of Bristol – https://eurognc.ceas.org/

**17-21** June – NVvL/CEAS – **IFSAD 2024** – 20th Edition of the Internal Forum on Aeroelasticity & Structural Dynamics - The Hague (NL) – New Babylon Congress Centre – https://www.ifasd2024.nl

**19-20** June – FSF – **IFSAD 2024** – Aviation Weather Resilience – Brussels (Belgium) – EUROCONTROL/HQ – Benik@FlightSafety.org – https://flightsafety.org/events

### JULY

**02-04** July – ACI EUROPE – **34th ACI Europe Annual Congress & general Assembly 2024** – Istanbul (Turkey) – Swissotel The Bosphorus – https://www.aci-europe/events.html

**22-26** July – Farnborough – **Farnborough International Air Show** – Pioneer the Future – Farnborough, Hampshire (UK) – https://farnboroughairshow/com

**22-26** July – EUROMECH – **ENOC11- 11th European Nonlinear Oscillations Conference** – Delft (NL) – https://euromech.org/

**29** July - **02** August – AIAA – **AIAA Aviation Forum** – Las Vegas, NV (USA) – www.aiaa.org/events

**30** July - **02** August – ASCEND powered by AIAA – **ASCEND Conference** – Las Vegas, NV (USA) – www.aiaa.org/events

### SEPTEMBER

**09-13** September – ICAS – Hosted by AIDAA – **34th Congress of the International Council of the Aeronautical Sciences –** Florence (Italy) – www.icas2024.com

**10-12** September – 3AF/CEAS – **ERF2024 –** 50th Edition of the European Rotorcraft Forum – Marseille (France) – Palais du Pharo – https://www.3af-erf2024.com

**10-13** September – ERCOFTAC – **FMC2024 – XXVI Fluid Mechanics Conference –** Warsaw (Poland) – https://fmc2024.pl.edu.pl

**16-20** September – EUROMECH – **EFD1 – 1st European Fluid Dynamics Conference** – Aachen (Germany) – https://euromech.org/

**18-19** September – ESA – **ISD 2024** – Industry Space Days - - Space for business opportunities – Noordwijk (NL) – ESA/ESTEC – https://atpi.eventsair.com/

**25-27** September – ICAS – **SESECA 2024 – 11th International Systems & Concurrent Engineering for Space Applications Conference –** Noordwijk (NL) – ESA/ESTEC – https://api.eventsair.com/

CEAS
Council of European Aerospace Societies

BULLETIN
AEROSPACE EUROPE

## AMONG UPCOMING AEROSPACE EVENTS

### OCTOBER

**8-11** October – EASN – **14th EASN International Conference –** Innovation: Aviation and Space towards sustainability today and tomorrow. Thessaloniki (Greece) – Concert Hall – https://www.easnconference.eu

**14-18** October – IAF/IAC – Hosted by AIDAA – **75th International Astronautical Congress –** Milan (Italy) – www.iac2024.org

**15-18** October –ESA – **SPCD 2024 – 5th Space Passive Components Days –** Noordwijk (NL) – ESA/ESTEC – https://atpi.eventsair.com/

**29-31** October –ADAirexpo – **Abu Dhabi Air Expo & Heli Expo 2024 –** Aviation & Aerospace Exhibition – Join the eaders in the aviation industry – Abu Dhabi (UAE) – https://www.adairexpo.com

### NOVEMBER

**12-17** November – China – **AirshowChina 2024 –** China International Aviation & Aerospace Exhibition – Zhuhai Guangdong (China) – www.airshow.com.en

**13-15** November – Bahrain – **BIAS2024 –** Bahrain International Airshow 2024 – 10-Year Anniversary – Sakhir Air Base (Bahrain) – https://www.bahraininternationalairshow.com