CEAS
Council of European Aerospace Societies

BULLETIN

AEROSPACE EUROPE

NASA NAMES ASTRONAUTS TO NEXT MOON MISSION, FIRST CREW UNDER ARTEMIS

© The crew of NASA's Artemis II mission (left to right): NASA astronauts Christina Hammock Koch, Reid Wiseman (seated), Victor Glover, and Canadian Space Agency astronaut Jeremy Hansen.
Credits: NASA

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);
- 4 Corporate Members: ESA, EASA, EUROCONTROL and EUROAVIA;
- 9 Societies having signed a Memorandum of Understanding (MoU) with CEAS: AAE (Air and Space Academy), AIAA (American Institute of Aeronautics and Astronautics), CSA (Chinese Society of Astronautics), EASN (European Aeronautics Science Network), EREA (European association of Research Establishments in Aeronautics), ICAS (International Council of Aeronautical Sciences), KSAS (Korean Society for Aeronautical and Space Sciences), PEGASUS (Partnership of a European Group of Aeronautics and Space Universities) and Society of Flight Test Engineers (SFTE-EC).

CEAS is governed by a Board of Trustees, with representatives of each of the Member Societies. Its Head Office is located in Belgium: c/o DLR – Rue du Trône 98 – 1050 Brussels. www.ceas.org

AEROSPACE EUROPE

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

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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

ABOUT THE ARTEMIS PROGRAMME CONTINUATION

ARTEMIS II - Three months after the issue 1-2023 of our CEAS bulletin whose front page illustrated the Artemis I mission this is with the Artemis II crew that we open the issue 2-2023. Set upon the successful uninhabited Artemis I flight completed on 11 December 2022, Artemis II will be the first crewed mission of the programme. Programmed to be launched in the second half of 2024, its objective will be to validate the human machine interface of the Orion capsule, to perform a rendezvous with the NASA Space Launch System upper stage after separation and once in High Earth Orbit, and then to validate all crew operations in flight and on ground before and after flight. In short the primary objective is to test all capabilities and techniques needed to live and work in deep space, paving the way for future long-term human exploration missions to the Moon and beyond. The crew is composed of three NASA astronauts – Reid Wiseman, Commander; Victor Glover, Pilot; Christine Hanmock, Mission Specialist - and one Canadian Space Agency astronaut, Jeremy Heinsen, Mission Specialist.
NASA Administrator Bill Nelson commented:
"*We are ushering a new era of exploration for a new generation of star sailors and dreamers, the Artemis generation.*"

Artemis II is lengthily described in pages 28 to 32, as well as the first following steps of the programme with special focus on Artemis III.

ARTEMIS III – This mission, expected to take place in the end of 2025, its duration will be about three weeks including six days on the South Pole of the Moon. Among main objectives is the performance of the first i landing of astronauts on the Moon since Apollo 17 in December 1972, the last mission of NASA Apollo programme. The crew composition will be four NASA astronauts.

ARTEMIS IV – It is hoped that Artemis IV will be the first mission with one ESA astronaut being part of the crew and being the first European to set the foot on the Moon!
These new perspectives are generating a strong enthusiasm for space exploration in the aerospace students and young professionals' population, as the latest ESA astronaut recruitment clearly highlighted. The call for applicants launched in March 2021 was hugely successful, attracting more than 23 000 candidates from across the Member States! On 23 November 2022 the ESA DG Josef Aschbacher welcomed at Grand Palais Ephémère in Paris the 17 members of the New ESA Astronaut Class 2022 composed of 5 career astronauts, 11 members of an astronaut reserve and one astronaut in disability. This is among the ESA Astronauts Corps 2022 that the Artemis IV European crew member will be selected. Josef Aschbacher commented:
"*This ESA astronaut class is bringing ambition, talent and diversity in many different forms [...] to drive in exploration in LEO on the ISS, going forward to the Moon and beyond.*"

Jean-Pierre Sanfourche,
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CEAS PRESIDENT'S MESSAGE

Franco Bernelli Zazzera
CEAS President 2021-2023

The first quarter of this year for CEAS was characterized by the intense co-organization activity of the Aerospace Europe Conference together with EUCASS. The event is presented in detail in a dedicated section of this bulletin, but I would like to emphasize here that, so far, the joint conference idea appears to be a success. The number of papers submitted is in the order of 700, coming from 41 countries. This will lead, after the paper selection, to the largest European conference in the aerospace sector. This result has been achieved thanks to the strong networking activity and connections that both CEAS and EUCASS have promoted. It is not surprising that the largest contributions come from Germany, France and Italy, but the good news is that there are significant contributions also from non-European countries such as Korea and China. A relevant contribution comes from students, representing the corresponding author of approximately one third of the submitted papers. This is important for the development of the aerospace sector in Europe and CEAS is happy to support the participation of 12 students to the event.

The anticipated success of the Aerospace Europe Conference allows me to make some considerations on the strengthening of the cooperation and potential integration of the activities of CEAS and all the other European non-profit associations related to aerospace, towards large European events. The rationale behind this action is that it is fundamental that in Europe we all further strengthen the different national cooperation among the different European societies and transnational associations. At present CEAS has roughly 35.000 individual members from the UK, France, Germany, Spain, Italy, The Netherlands, Sweden, Poland, Switzerland, Czech Republic, and Romania. CEAS has now four Corporate Members: ESA, EASA, Eurocontrol and Euroavia. The European scenario includes then also, in addition to EUCASS, the European Aeronautics Science Network (EASN), the Air and Space Academy (AAE), the Partnership of a European Group of Aeronautics and Space Universities (PEGASUS). Each association was set up with a specific objective and motivation, and probably, if we look carefully, we can understand that the objectives are complementary and, in any case, serve the same community, European aerospace scientists and engineers. It is a fact that the 2023 conference has seen contributions also from EASN and a relevant participation in the Technical Committee of colleagues from PEGASUS. This edition of the bulletin includes two contributions from AAE and one from EREA. Some CEAS past-Presidents are also members of the AAE and have brought to the attention of AAE this important vision for the future. Considering that CEAS is the only, truly European organization with exclusive relations through its national member societies and its extensive set of Memoranda of Understanding/Cooperation (with the International Council for the Aeronautical Science - ICAS, the American Institute for Aeronautics and Astronautics - AIAA, the European research Establishments Association – EREA, the EASN, the AAE, the PEGASUS, and Korean and Chinese aerospace societies), its frame can serve as a natural body to further federate European efforts.

I am willing to support the idea of organizing a well-prepared meeting of the presidents of AAE, CEAS, EUCASS, EASN and PEGASUS (and possibly others like EREA) to develop a vision and strategy towards this goal. I will bring this idea to the attention of the CEAS Board of Trustees, as it needs broad consensus from the CEAS to be sustained in future years. I know it won't be easy, but we should try.

AIRBUS PIONEERS SUSTAINABLE AVIATION FOR AN OPEN AND ENVIRONMENTALLY FRIENDLY WORLD

By Alain de ZOTTI, Chief Engineer Architecture and Integration – Airbus

With his kind authorisation, we reproduce here after the editorial Alain De Zotti published in Newsletter 128 of the Air and Space Academy.

Alain de Zotti

The preamble to the Chicago Convention in 1944 states: "international civil aviation can greatly help to create and preserve friendship and understanding among the nations and peoples of the world". At Airbus, we believe in the positive contribution of aviation to our societies and are determined to ensure that present and future generations continue to benefit from it.

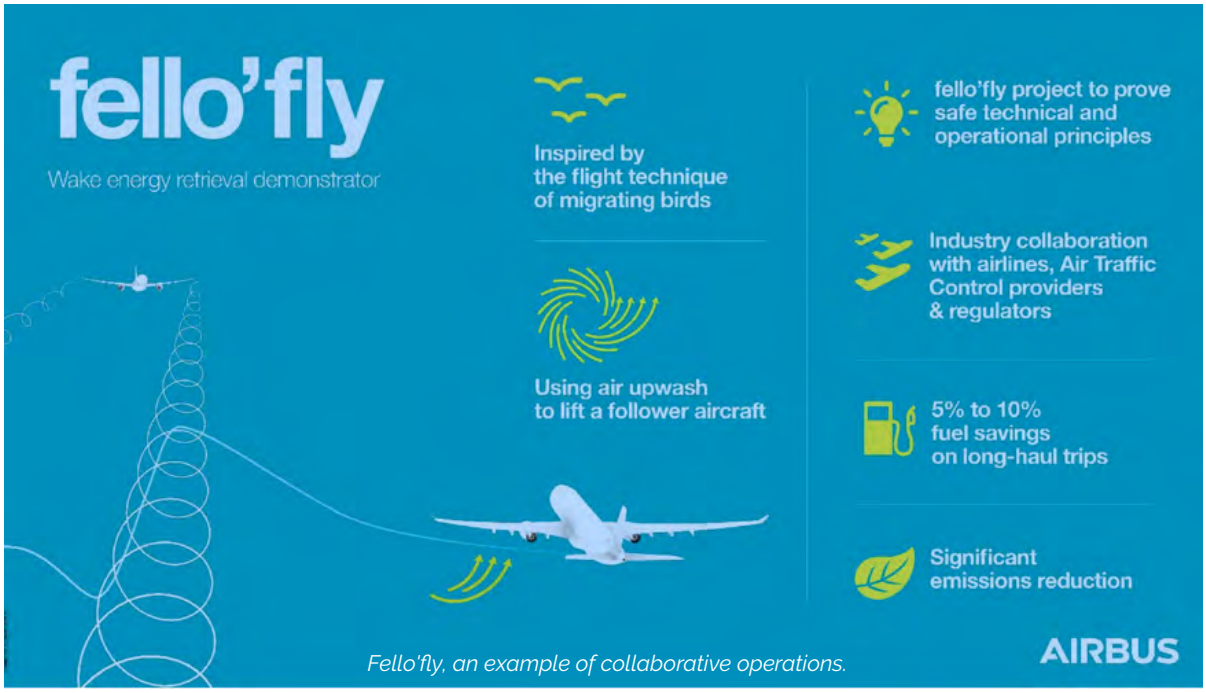
This includes, among others, finding solutions to reduce the impact of aviation on climate change.
Air transport is responsible for 2.5% of anthropogenic CO emissions. When "non-CO_2" effects are considered in the radiation balance (see AAE Newsletter 127), the contribution of aviation increases to 3.5%.

Given the concentration, but also the excellent global organisation of this sector, its researchers and engineers have a rare opportunity to act on a global scale. To this end they have various complementary means of action.

The first is fleet renewal, which consists of taking advantage of the research, developments and industry investments of recent years. This is a powerful lever because only 20% of the world's fleets today are made up of the latest generation aircraft. The current production of Airbus, for example, has a carbon intensity of 63 g CO_2e/passenger kilometre. This figure, which takes into account aircraft emissions during use and the average load factor, was cut by 20% between 2015 and 2022.

The second avenue for action is to continue the quest for performance and sobriety that is the hallmark of our industry, by continuing to invest in research programmes that will enable another leap in efficiency in the middle of the next decade.
The theoretical levers are known.
On subsonic aircraft, wave drag is now negligible. Lift-induced drag will be reduced by increasing the wingspan. Wing mass will be minimised through active load and flutter control thanks to reliable, ultra- high speed flight control systems. A change in certification rules in this area will be necessary. Frictional drag can be minimised by laminarity control and the introduction of turbulent boundary layer manipulators inside the paint. Both of these technologies have been demonstrated in flight and their incorporation into a product will depend

A380 flying demonstrator of the CFM non-ducted fan engine.



Fello'fly, an example of collaborative operations.

on the operational context of the final product.
The thermo-propulsive efficiency of the engines will continue to improve via an increase in the bypass ratio, made possible by the generalisation of configurations where a gearbox drives a fan, shrouded or not. In both cases, aerodynamic integration with the carrier will require co-creation of aerodynamic shapes between the aircraft and engine manufacturers. The compression ratio and temperature of the combustion chamber will increase only moderately. Energy exchanges can be optimised via a high-power electrical network connecting the various engine and aircraft components. This electric hybridisation will benefit from the introduction of solid electrolyte batteries, a technology which is undergoing considerable research, particularly in the automobile sector.

Although performing increasingly complex functions necessary for safe and efficient flight, the weight of avionics and electrical systems will be reduced through integration into a single multifunction platform.
The digital data exchanges made possible by connectivity technologies will enable trajectory optimisation to move from a single-aircraft to a multi-fleet scale. Once the scientific uncertainties have been reduced and an optimisation criterion chosen, these techniques will also serve to minimise contrails.

These components will be synergistically integrated into an optimised configuration: classic "tube and wing" with an under-wing engine, or combining laminar wing and rear propulsion, or even a flying wing.
In order to reduce the uncertainties linked to these new technologies as quickly as possible, but also to train a new generation of engineers, Airbus has embarked on a process of demonstrators, some examples of which are illustrated by two images in this article.

The third means of action is to reconsider the fuel used.
After an exhaustive review of the various solutions, the two remaining candidates for commercial aviation are sustainable aviation fuels (SAF) and hydrogen stored in liquid form at cryogenic temperature.

When burned, SAF produce the same amount of CO_2 as conventional fuel, but this CO_2 has previously been captured naturally from the atmosphere. It is estimated that sustainable aviation fuels can reduce greenhouse gas emissions by up to 80% over their life cycle. In the future, starting with artificially captured CO_2 from the atmosphere and decarbonised hydrogen, this figure could approach 100%.

From an aircraft perspective, there are currently seven production routes for these drop-in fuels, which have been shown to maintain the properties of conventional fuel when blended at a maximum of 50%. This limit is essentially set to maintain a sufficient level of aromatic hydrocarbons in the final fuel regardless of the origin of the conventional fuel used in the blend. It could be raised by introducing synthetic aromatics into the synthetic fuel. This is the subject of an evolution in 2023 of the ASTM standard (ASTM International is the body governing the safety and performance of aviation fuels). With this miscible fuel, today's aircraft will be 100% SAF compatible.
The next step will be to reduce these synthetic aromatics, to minimise production costs and reduce non-volatile particulate emissions. However, as these aromatics

also affect the auto-ignition temperature of the fuel, technical or regulatory solutions will have to be found to ensure the same safety margins as today. This will be the subject of a new ASTM standard within the decade.
The "100% SAF" aircraft produced in the next few years will therefore be compatible with the zero emission objective in 2050. As the residual emissions from using 100% SAF are low, they can be offset by external measures, such as CO_2 capture, which is also being studied by Airbus.

Hydrogen is the other possible fuel.

This could be consumed in a fuel cell, powering an electric propulsion system. The size of the aircraft will then be limited by the electrical power that can be brought into play, in the order of a multiple of a megawatt.
Hydrogen can also be burned in the combustion chamber of a 'conventional' engine, without power limitation, but at the cost of residual nitrogen oxide emissions, which will be minimised by optimising the combustion chambers by taking advantage of the excellent combustion properties of hydrogen.
In both cases, water replaces CO_2 as the essential product of fuel energy extraction. The effect on contrails remains to be studied experimentally.
In order to achieve the mass and volume density compatible with the needs of an aircraft, hydrogen must be stored essentially in liquid form at very low temperatures, around 20 kelvins.

The size, geometry and mass of the cryogenic tank make the hydrogen aircraft less energy efficient than its conventional fuel counterpart, but the production of the simple di-hydrogen molecule requires less energy than the more complex synthetic hydrocarbon molecules. The energy requirements of the complete "well to wake" chain are ultimately similar between the two fuels.
Based on knowledge acquired in particular in the space field, Airbus has demonstrated that, even with uncertainties regarding the performance of the various components, it was possible to balance out - in the sense of weight and performance - a commercial transport aircraft of variable size or range. However, the feasibility of the technologies in a civil aviation context still needs to be demonstrated. This is the purpose of the research programmes currently underway.

As with sustainable fuels, the development of an entire production ecosystem is necessary, including primary decarbonised energy sources. Airbus is also active in this field. For SAF, investment must be pushed through via regulatory measures, incentives or financing. Airbus has thus decided to create a "SAF fund" to enable, together with other partners, to raise funds for the creation of production units. Airbus also wants to stimulate innovation in this field with the development of new SAF manufacturing processes: "Alcohol to Jet", "Fischer Tropsch", "Power to Liquid", etc., making it possible to use larger resources and go beyond the potentially limited quantities of raw materials from biomass.

For decarbonated hydrogen, Airbus is working with certain airports such as Charles-de-Gaulle and Lyon-Saint-Exupéry in France to create 'hydrogen hubs' which will initially supply hydrogen-powered ground transport (cars, buses or trucks), and then make this hydrogen available to our ZEROe aircraft in liquid form.

Indeed we are working on a global transformation of the entire aeronautical ecosystem. A difficult challenge, but such a stimulating one, to enable the new generations to fly in an environmentally friendly manner and to continue to discover the world in a way that only air travel allows.

A Finnair A350 using SAF.

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.

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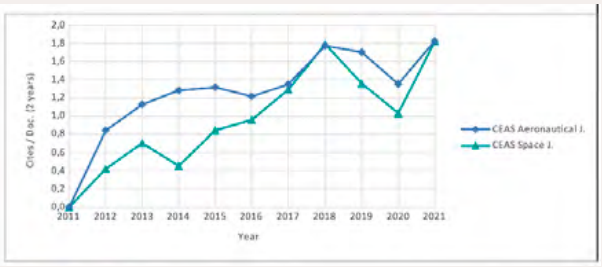

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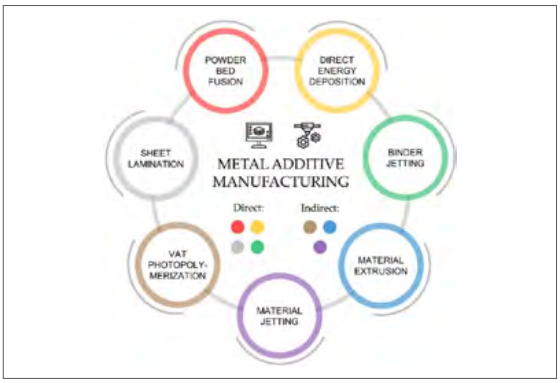

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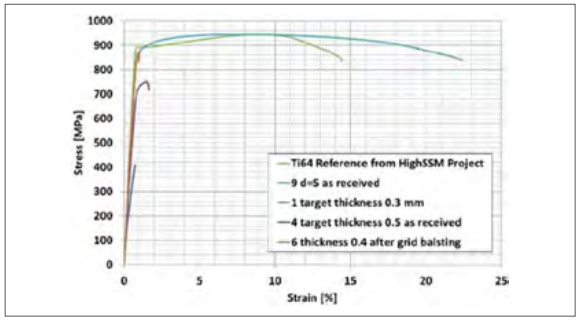

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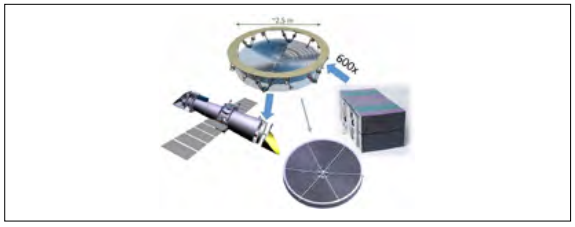

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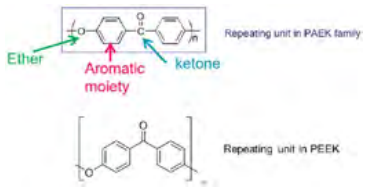

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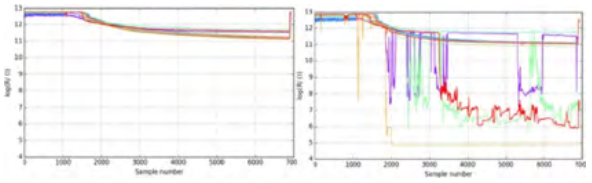

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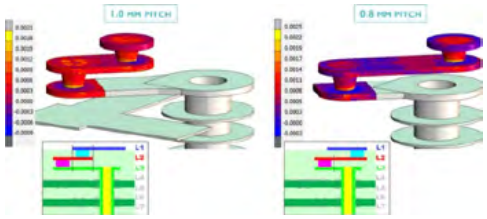

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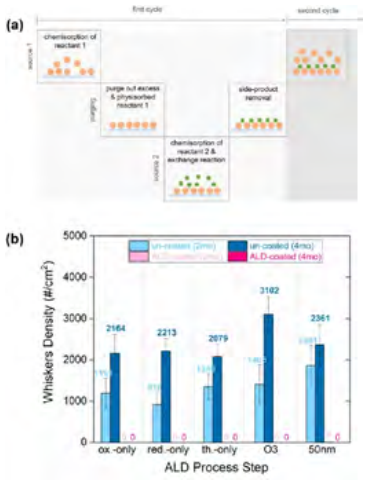

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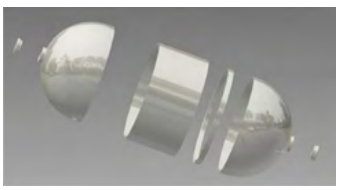

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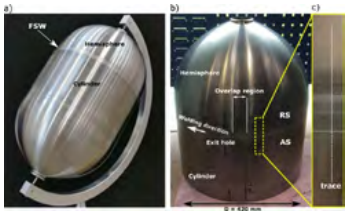

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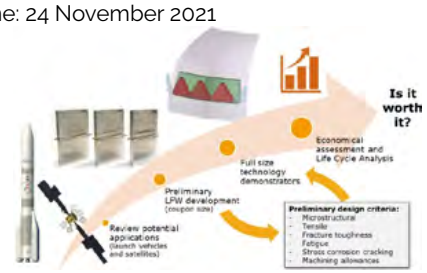

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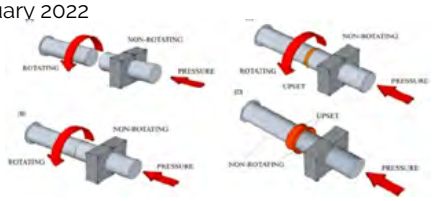

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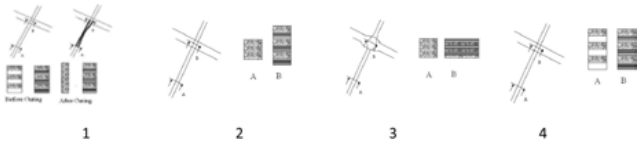

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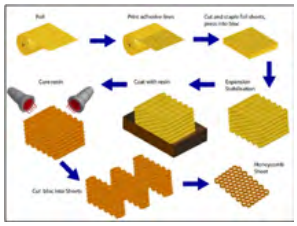

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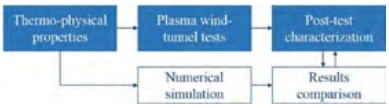

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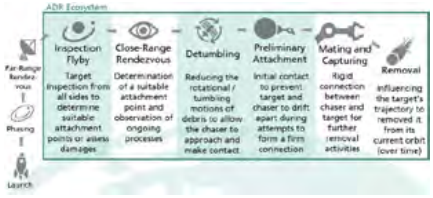

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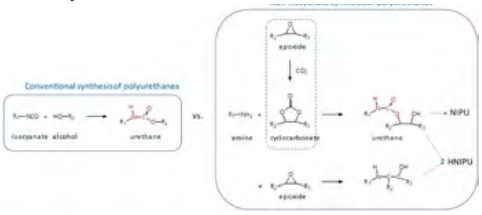

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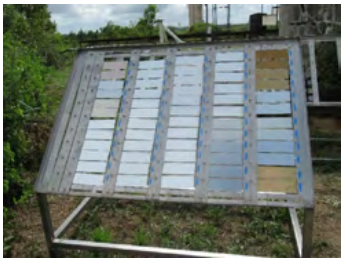

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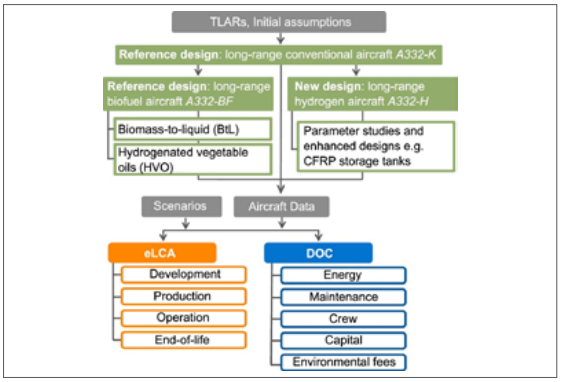

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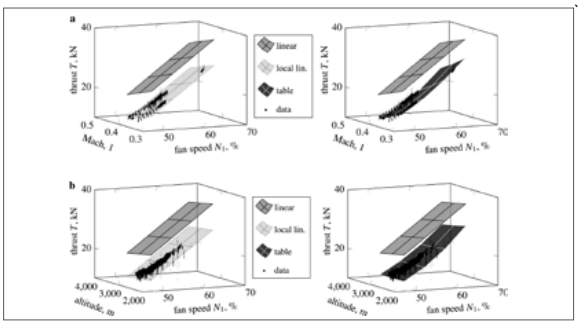

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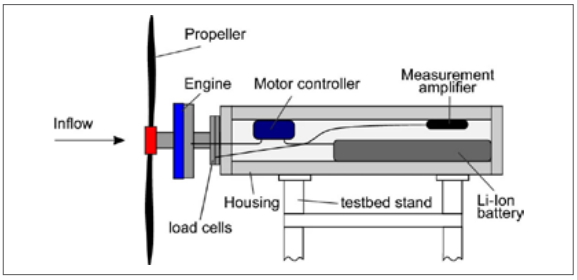

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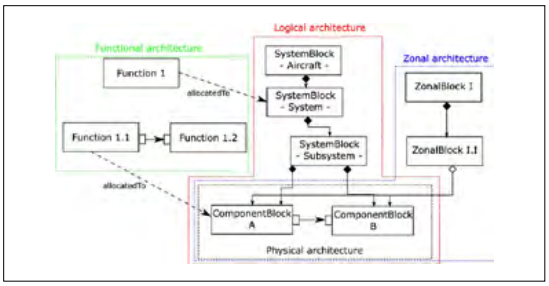

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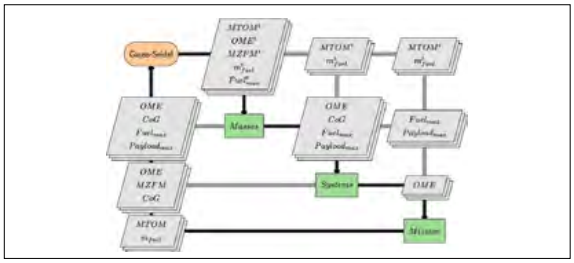

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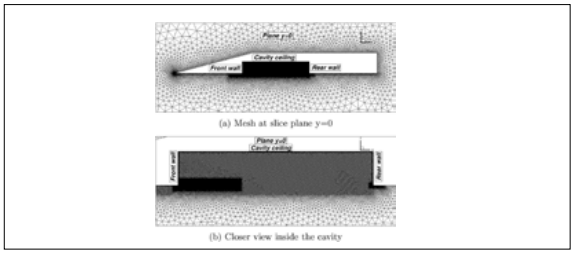

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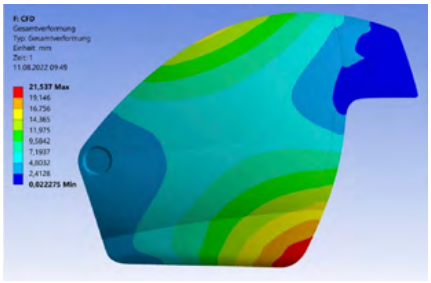

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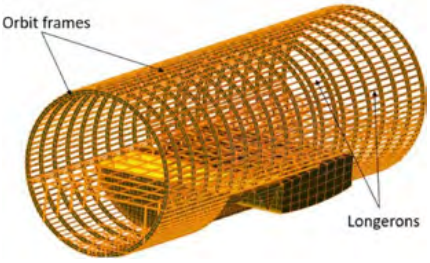

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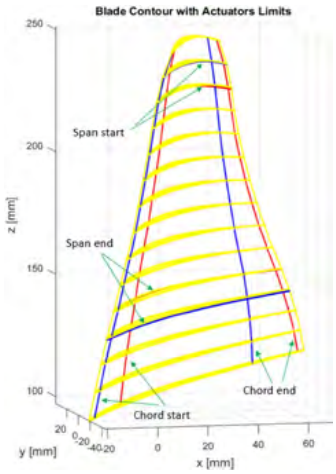

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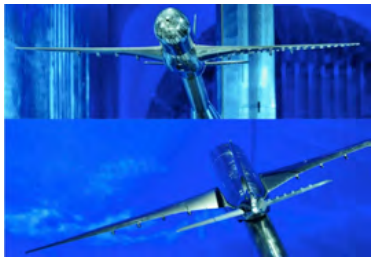

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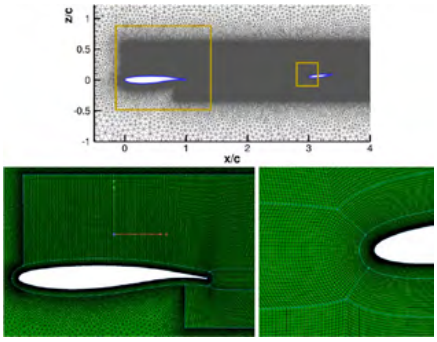

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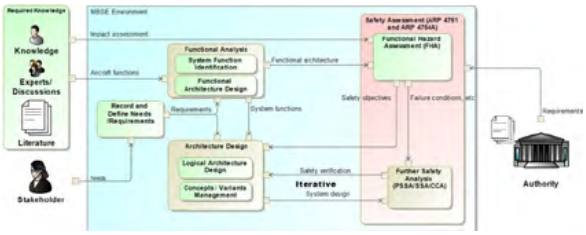

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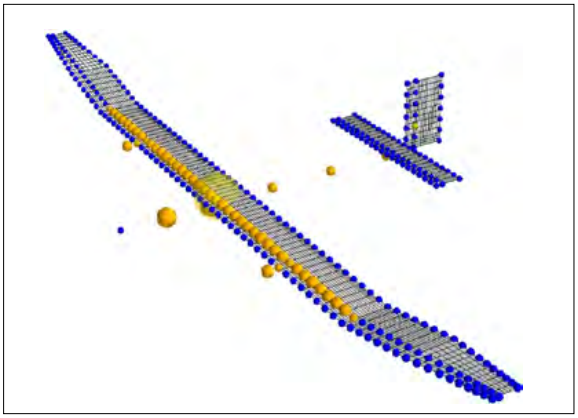

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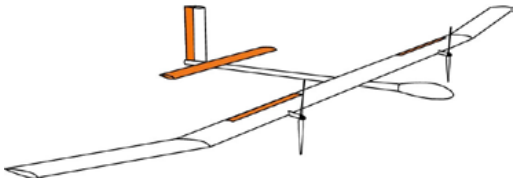

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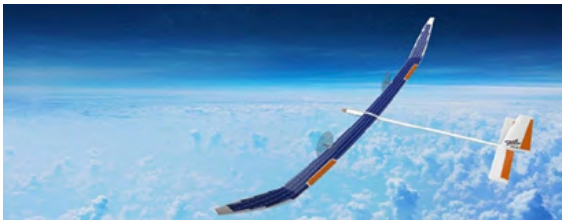

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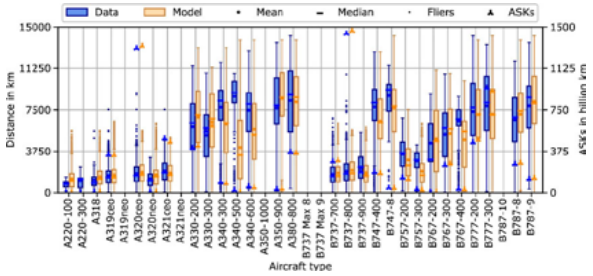

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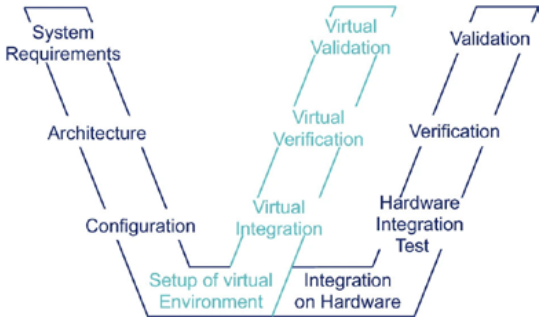

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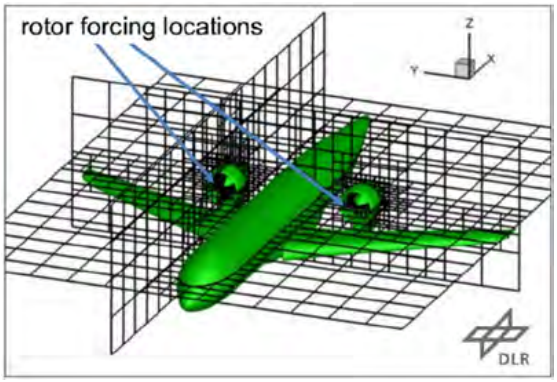
F. Boden, H. P. Barth, S. Hein, D. Heitmann, T. Kirmse, C. Klein, W. Krüger, J. Lemarechal, M. Norambuena, D. Schäfer, R. Schnell, K. Sinha, A. Theiß & A. Weiss / Published: 16 January 2023 (Open Access)



SESAR 2020 SHOW CASE

The SESAR 3 JU and partners showcased the very best of the SESAR 2020 project outcomes and results at Airspace World 8 to March 2023 in Geneva.
The conference gathered a vast range of stakeholders engaged in SESAR 3 JU Research and Development to:

- Learn about the SESAR 3 JU R&D done to date, the results, benefits and more specifically about those solutions ready for implementation;
- Find out about regulatory and standardisation activities underway to support the implementation of SESAR solutions;
- Hear from industry stakeholders who are already implementing SESAR solutions, learn about the real –life experiences an how SESAR innovation is benefiting their day-to-day operations;
- Attend the Digital European sky awards.

The showcase featured 16 sessions.
Among them, the ALBATROSS session here after presented.

The Consortium

sesar JOINT UNDERTAKING

A large Pan-European Consortium gathering 5 Airlines, 2 Airports, 4 ANSPs and many industrials

#SESARShowcase

The project approach

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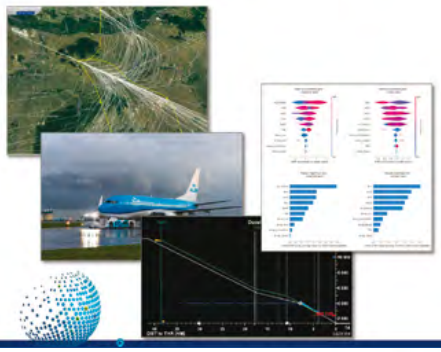
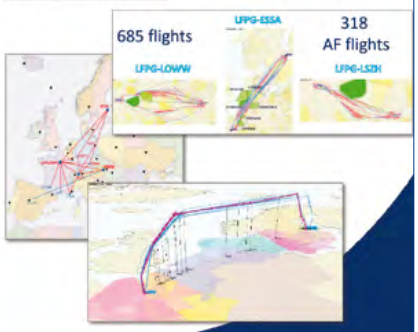
The Local Exercises



The "Gate-to Gate"



#EuropeForAviation

The Local Exercises

PBN to ILS

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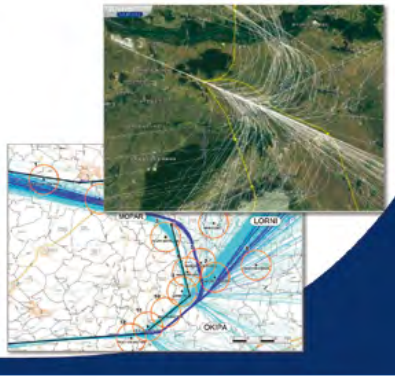
- Reduction of fuel and emissions from reduced track miles and improved flight efficiency
- Minimize noise exposure and avoid noise sensitive areas
- Assess the operational efficiency/capacity of this procedure

At Vienna Airport

- PBN to ILS Procedure for RWY 29 published in the AIP
  - Active H24 for all traffic (rwy used in off-peak periods or on request)
  - All flights following the new procedure are considered "demo flights"
- Curved Procedures (radius-to-fix) enabled by RNP to the interception of the final approach (ILS CATII/III or LOC)

At Paris-CDG Airport

- evaluation of the north-facing west-facing doublet system, part of the PBN to ILS/RNP project in Paris-Charles-De-Gaulle



#SESARShowcase

The Local Exercises

Taxi Bot

sesar JOINT UNDERTAKING

- Draft CONOPS for standard Sustainable Taxiing operations with narrow bodies
- Updated design of the TaxiBot, including relevant subsystems
- Improved training materials and actual training of pilots & tug drivers
- Development and realization of several infrastructural modifications to allow for TaxiBotting operations to and from the Polderbaan
- Operational showcase on December 6th 2022
- *Savings expected at ground level: 50% - 85%*

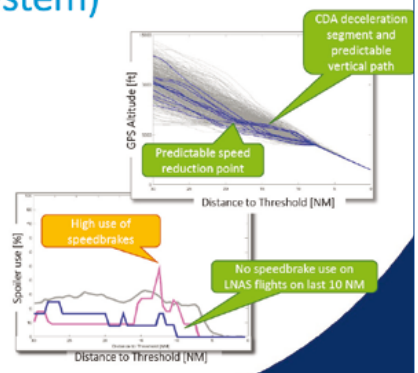
#SESARShowcase

#EuropeForAviation

The Local Exercises

LNAS (Low Noise Augmentation System)

- Objective: to **evaluate the benefits of a closed-path PBN-to-ILS procedure** with and without a **CDA Energy Management Pilot Assistance System (LNAS)** compared to Radar Vectoring to the same runway.
- Flights along the PBN-to-ILS trajectory conducted with vs. without LNAS aircraft energy management support resulted in:
  - Significantly more predictable vertical and airspeed profiles
  - Lower use of speed brakes particularly at low altitudes
  - Lower average thrust settings
  - **6 % fuel and CO2 savings on last 30 NM** (compared to Baseline)



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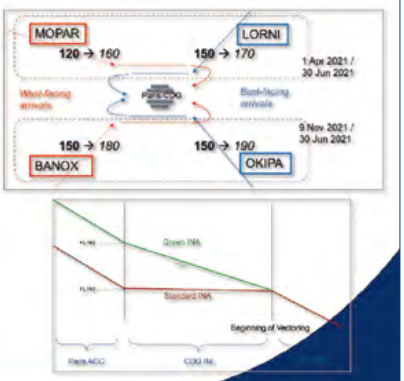
The Local Exercises

Optimized Descents on CDG

- Optimized descents in the Paris area, in specific traffic conditions
- Improved coordination between control centers allows to "relaxed" certain interfaces : "altitudes at the IAFs raised in low traffic conditions" (~4 hours per day) for the downwind arrivals
- Enables less or shorter level-offs, performed a higher flight levels
- Multiple rounds of trials resulted in **semi-permanent activation** via an AIP-SUP (permanent publication may follow soon)
- *Between 50kg and 150kg of fuel saved per approach (Depending on the aircraft type)*
- *Number of improved flights estimated at more than 5 000*



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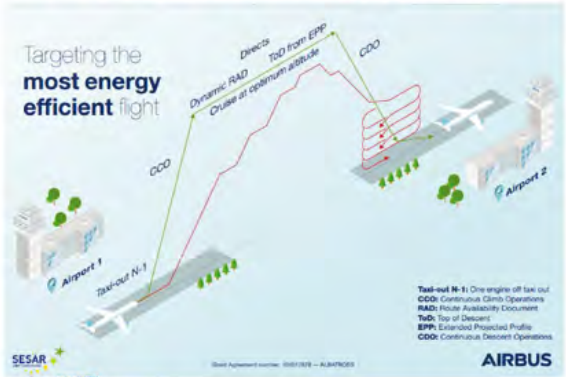
The "Gate to Gate" approach



Identification of City Pairs
Aircraft Operators, Airport Authorities, ATM service providers confirm availability NM's and military support

Calculation of Optimum Flights

Identification of ATM constraints
RAD restrictions (level-cap), Military Areas, Ground or TMA operations, ATFM measures, ATC instructions, Airspace Design, LoA's, Route Charges

Solutions towards the Optimum Flight
RNP, xBAS, ADS-C, air-ground information exchange, data analytics tools, etc.

Finalization of the preparatory phase
Operational Instructions, safety assesments, trainings, publications (NOP, AIS, Bulletins)

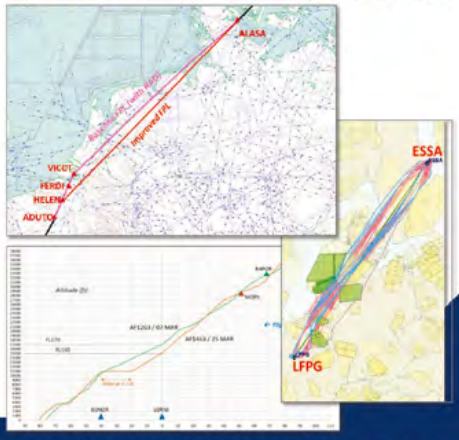
Trials Planning & Execution

#SESARShowcase #EuropeForAviation

The "Gate to Gate"

Stockholm (and Vienna, Zürich) G2G

- Sorted by the coverage available to facilitate **CDM process required to apply the G2G Methodology**
- MUAC to Paris-ACC interface raised to FL310
- MUAC FMP identified greener trajectories and sent the re-route proposal (RRP) to the AOs
- MUAC offered to alleviate the mandatory waypoint VICOT, allowing an earlier turn to the north-east at FERDI.
- DSNA allowed, under specific circumstances, a less constraining altitude (FL170 instead of FL150) on the IAF point "LORNI"
- The flights took advantage of the FRA in Swedish Airspace



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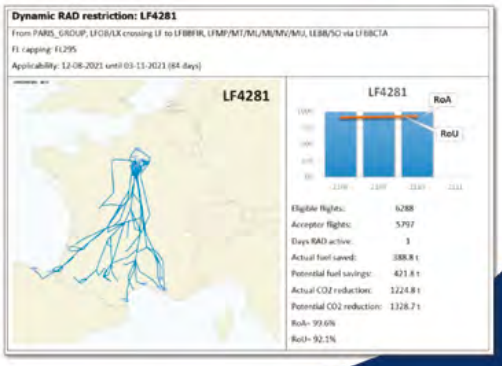
The "Gate to Gate"

The Dynamic RAD trials

- Purpose: Introduce more flexibility in the management of RAD restrictions
- Promote flight efficiency, avoiding unnecessary traffic constraints in case of sustainable demand
- Freedom of the ANSPs to decide whether to apply the concept and which restrictions could be eligible for a dynamic management
- To measure the potential and actual benefits, two indicators were defined, applicable to each restriction:
  - **Rate of Availability (RoA):** duration of RAD restriction suspension within 24 h. It can be calculated daily or for the AIRAC
  - **Rate of Uptake (RoU):** portion of the eligible flights that have accepted the restriction relaxation according to the FPL information



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Conclusion & Recommendations

- Being a SESAR "Very Largescale Demonstration", **the project focused on concepts having sufficient maturity to quickly become ready** for real operations, and bring immediate benefit.
- The exercises demonstrated the **sustainability of operations on the long term**, and aimed to offer improvements as far as available.
- **Many hundreds of flights took benefits of the ATM improvements** whenever available: the target was not to execute a single special flight, in exceptionally protected conditions.

More than 1000 flights were performed and 5000 Tons of CO2 saved!

#SESARShowcase #EuropeForAviation

EREA PRESENTED ITS VIEWS ON THE PAST, PRESENT AND FUTURE OF THE EUROPEAN RESEARCH & INNOVATION FRAMEWORK PROGRAMMES 2014-2027

EREA welcomed the opportunity offered by the European Commission through the recently closed **Public consultation on the past, present and future of the European Research & Innovation Framework programmes 2014-2027** to present its views on the above mentioned European Research & Innovation Framework programmes.

With this Public Consultation **EREA takes the opportunity to also present a more elaborated EREA position on the past, present & future of the European Framework Programmes for Research and Innovation 2014-2027** and to call for increased investment in R&I for a better future, where success depends more and more on the generation and conversion of knowledge into innovations.

In the Position Paper, EREA highlighted the following key messages:

- It is of utmost importance that the **Framework Programme for Research and Innovation funds and supports the entire R&I chain, from basic research, application-oriented research, technology demonstration and validation up to innovation, to ensure European leadership and European competitiveness in the world.**

- **Increasing R&I investment is crucial for Europe's future at a time of high global competitiveness**, when success increasingly depends on the generation and conversion of knowledge into innovation.

- **Collaborative research and partnerships, in particular between industry, research organisations and universities, are key instruments to ensure a rapid transfer of knowledge to applications and thus innovation**. This is the main added value of EU-wide cooperation.

- **EREA emphasizes the need to consider and support Technology Infrastructures (TIs) in an appropriate way** - for any technological breakthrough, TIs are key to prove an idea, test it, validate the technology and highlight its effectiveness and impact (instrumental for scaling up). Europe needs a landscape of large-scale, high-quality TIs covering the entire TRL ladder as well as a network of smaller facilities serving local innovative ecosystems. **EREA calls for high-level European support actions for aviation Technology Infrastructures in the second part of Horizon Europe and the following Framework Programmes.**

- There are dedicated tools at the EU level to fund the implementation of Missions, e.g., European Fund for Strategic Investments (EFSI), Structural and Investment Funds (ESIF), Connecting Europe Facility (CEF), Digital Europe and others, this being the reason why E**REA strongly discourages the use of a dedicated R&I programme budget for this purpose.**

- EREA is in favour of a fair balance between joint research projects and individual funding measures (ERC; EIC) and emphasizes once again the immense added value of cross-border cooperation and collaboration between researchers from industry, research organizations and universities in joint European projects.

- **EREA welcomes any kind of simplification effort if researchers (and their institutions) can really benefit from it.** In the "Lump Sum" approach, shifting the administrative burden from the accounting phase (during and after the lifetime of the project) to the project preparation phase goes against the objective of simplification, could even lead to less European cooperation within an EU project and due to higher uncertainties, the measure is even counterproductive.

- EREA welcomes any initiative by the **European Commission to better align the programming and funding rules of the different EU funds to allow for greater coherence and synergies.**

You can read all the details in the complete EREA position on the past, present & future of the European Framework Programmes for Research and Innovation 2014-2027.

TOWARDS A WORLD OF MORE AUTONOMOUS AIR TRAVEL

COULD THE HUMBLE GRAGONFLY HELP PILOTS DURING FLIGHT?

Where using autonomous technology to further enhance safety

The Airbus UpNext DragonFly demonstrator takes inspiration from the incredible vision and intelligent flight capabilities of the dragonfly. DragonFly has now entered the final three months of its testing phase, which will put its flightpath capability, automated landing technology, and pilot assistance technology through its paces.

AIRBUS UPNEXT DRAGONFLY DEMONSTRATOR

When safety is concerned, continuous improvement is the name of the game. At Airbus, we are constantly looking to different sources of inspiration to find proactive solutions that can enhance safety and improve performance.
And what better to be inspired by than the wonderful, natural world? Biologically-inspired engineering – or biomimicry – has led us to many of our creative solutions, from our "sharklet" wing-tip design that reduces drag, to our fello'fly demonstrator that mimics the formation flying of snow geese for improved performance.

Our latest demonstrator to use biomimicry is DragonFly, inspired by – you guessed it – the dragonfly. A dragonfly has phenomenal vision, the ability to see in 360˚, and can recognise landmarks, which in turn help it to define its territorial boundaries. The systems we are developing and testing are similarly designed to review and identify features in the landscape that enable the aircraft to "see" and safely manoeuvre within its surroundings.

These innovations can offer an additional layer of safety for aircraft, particularly in the context of emergency operations. In the unlikely situation where a crew is unable to control the aircraft, DragonFly can redirect the flight to the nearest appropriate airport and facilitate a safe landing.

SO HOW DOES IT WORK?

DragonFly could be a game-changer when it comes to derisking emergency operations. Its focus is on three key areas, each one drawing on a combination of data captured during flight and a vast corpus of flight information to promote automated yet intelligent decision making.
DragonFly offers a solution to help ensure safe flight and landing. If the crew are unable to control the aircraft, the onboard function detects the issue and automatically selects the most suitable airport to redirect the aircraft towards.

But of course flight paths and external factors are complex and changing. A dragonfly scans its surroundings and adapts its journey accordingly. Our DragonFly demonstrator does much the same thing, taking into account external factors such as flight zones, terrain and weather conditions as it chooses where to land. But

unlike a regular dragonfly, our DragonFly also benefits from a constant channel of communication between the aircraft and both Air Traffic Control and the Operations Control Centre of the airline to ensure a safe and coordinated approach.

> *In the same way that dragonflies can recognise landmarks that help them to define boundaries, our demonstrator is equipped with cutting-edge sensing technology and software, capable of managing in-flight and landing operations. The DragonFly demonstrator has been made possible through cooperation within the Airbus engineering community and with our trusted external partners, and we look forward to the insights that this final stage of testing will deliver.*
>
> *Isabelle Lacaze, Head of DragonFly demonstrator, Airbus UpNext*

AIRBUS UPNEXT DRAGONFLY DEMONSTRATOR - TAXIING PHASE

SAFE, AUTOMATED LANDING AT ANY AIRPORT IN THE WORLD

A dragonfly's vision works far more quickly than a human's, which is why we have designed a system that combines sensors, computer vision algorithms and robust guidance calculations to make landing in low visibility or difficult weather conditions much easier.

These innovations pave the way for automated landing (if necessary), or can be customised according to the pilot's flying skills to relieve them of additional processes in the event of an emergency or critical situation.

In time, DragonFly's innovations could allow the aircraft to land at any airport in the world regardless of whether it is equipped with existing ground equipment technology currently used for automatic landing.

The final aspect of the DragonFly demonstrator incorporates pilot assistance technology to help the crew manage taxi guidance and instructions, including navigation and surveillance, freeing them up to focus on other important tasks.

WHAT'S NEXT?

DragonFly has now entered the final three months of its testing phase. These testing flights will enable Airbus UpNext to update or confirm the technology with the view to integrating improvements into future programmes.

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

By Jean-Pierre Sanfourche, Editor in Chief

AIR POWER EUROPEAN COOPERATION EN ROUTE TO FIRST FLIGHT

*Armament Colonel **Philippe Koffi** is Head of Joint French, German and Spanish Team in charge of the FCAS (Future Combat Air System) programme management at DGA.*

Concluding very long negotiations between European industrial companies, an agreement was obtained on 1st December 2022, concerning the Future Combat Air System (FCAS). As soon as 15 December, the French Armament Procurement Agency (DGA) signed the contracts with industry for the co-called 'Phase 1B' of this programme, so marking a decisive step forward. Before going into details of this Phase 1B, could we recall the genesis of FCAS?

The genesis of this project can be found in July 2017 when President Macron and Chancellor Merkel agreed to develop a new generation fighter. The next move was made in April 2018 with former German Defence Minister Ursula von der Leyen and French Defence Minister Florence Parly deciding to allocate the leadership of the NGWS (Next Generation Weapon System) project to France and the leadership of the MGCS (Main Ground Combat System) project to Germany.

Then 2019 can be considered as a critical year for the project with the launch in January of a Joint Concept Study aiming at downselecting the most promising NGWS architectures and NGF (Next Generation Fighter) concepts, with the signature in March of a High Level Common Operational Requirements (HLCORD) by France, Germany and Spain and with the signature in June at the Paris Air Show of a Framework Agreement by the 3 nations.

We must also mention the award of the Phase 1A contract in February 2020, which objectives were to outline the demonstrator concepts and to refine the technology roadmap in preparation of Phase 1B.

Before starting to review with you the details of this Phase 1B, I feel the necessity to well understand the Next Generation Weapon System (NGWS) concept because NGWS and FCAS concepts are closely interconnected.

You are right. The Next Generation Weapon System (NGWS) is a system of systems made of three major

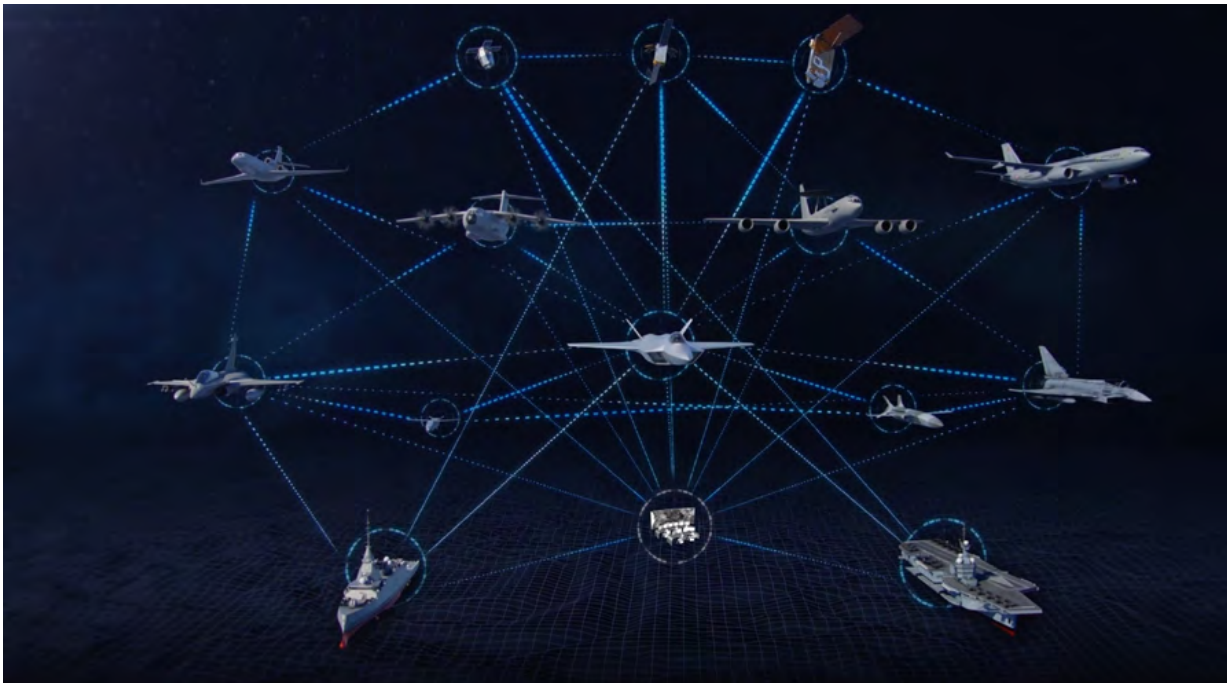


Figure 1 : Illustration of the FCAS project – Copyright DGA/MIP

components (*Figure 1*): the New Generation Fighter (NGF), the Remote Carriers (RC) and the Combat Cloud (CC). Targets are: 1) Air superiority in highly contested environments by 2040 and beyond (peer competitors with anti-access area denial capabilities and connected and smart weapon systems)- 2) efficient deployment in more permisive environments. We are now going towards a new paradigm: the collaborative combat, which implies a system of systems based upon a complex combinational logics. It is a mix of manned-unmanned forces whose major qualities will be: flexibility, reactivity and upgradability.
It is also to be understood that there is one core NGWS but that this NGWS extends to three national Future Combat Air Systems, which also include national systems (*Figure 2*).

Is Phase 1B applying to the whole NGWS?

With NGWS our ambition is very high but with ambition come risks. Thus we have decided to launch a R&T and demonstration phase to mitigate these risks and to increase the maturity of concepts and architectures and to level up the readiness of all key technologies.

Phase 1B is a part of this demonstration phase. It will last about 3 years and there is a bunch of objectives. On the operational side, we aim at identifying the most promising NGWS combination or architecture. On the demonstrator side, we will achieve a Preliminary Design Review Milestone, meaning that the trade-offs at system and subsystems levels will be completed and that the interfaces will be frozen for each main demonstrator (NGF, RCs…). Last but not least on the technology side, we will have achieved a TRL (Technology Readiness Level) comprised between 3 and 4 meaning we will have carried out lab tests.

What is the so-called Optional Phase 2?

Phase 1B will be immediately followed by a Phase 2. It is named 'Optional' because it will be conditioned by a formal agreement between the industrial companies involved at the end of Phase 1B in the end of 2025/early 2026. So, it is expected to begin without transition after completion of Phase 1B. The NGWS architecture pre-selected in Phase 1B will be refined and we will perform the development and manufacturing of the demonstrators. We expect their maiden flight by 2029.

What is Phase 1B-2 budget?

With 3 billion€ over 3 years, Phase 1B budget marks a significant breakthrough compared to Phase 1A (200 million€). To put that into perspective, this budget corresponds to having 3000 engineers working full time for the project.
And it will be even more for Phase 2 (4,5 billion€).

What are the main specifications of the Next generation Fighter?

The Next Generation Fighter (*Figure 3*) will be a highly capable multirole combat aircraft able to handle the full spectrum of A/A and A/G mission and also able to act as a command fighter. Its key features will be: high survivability based on manoeuvrability, low observability and electronic warfare, equipped with a full suite of interconnected advanced sensors, benefiting from virtual assistance and artificial intelligence (AI) in a new generation cockpit.

How are Remote Carriers specified?

Remote Carriers as unmanned systems act as force multipliers for the capabilities provided by NGWS and they allow for new tactical options (Figure 4). They also increase the quantity of combat power especially in high

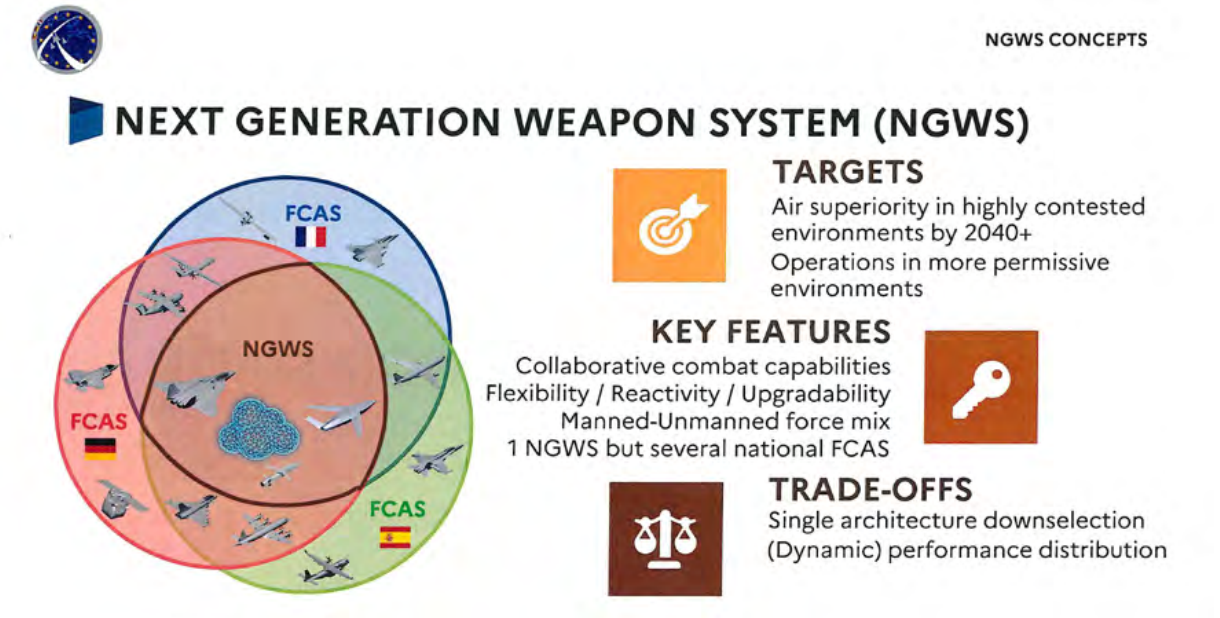


Figure 2 : Next Generation Weapon System (NGWS) – © DGA - NGWS Combined Project Team

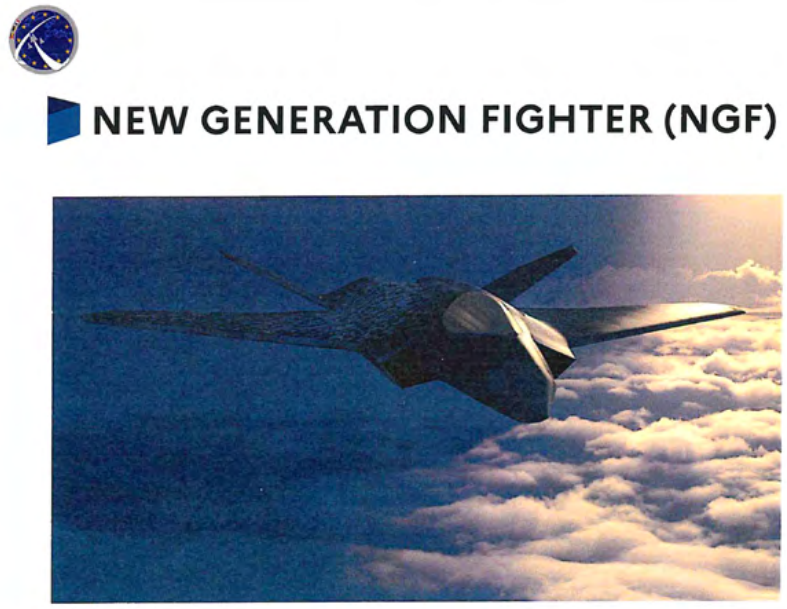


Figure 3 : Next Generation Fighter (NGF) – © DGA - NGWS Combined Project Team

or very high intensity environments where the number of assets matter.
They can be used in various ways such as saturating ground threats or as additional sensors for electronic warfare or ISR purposes. And they can carry additional weapon payload.
When we talk about RCs, we talk about assets ranging from several hundred kilos to several tons. The lightest ones will be by essence expandable but even the heaviest must be designed to be affordable in order to achieve the necessary combat mass.
A critical feature will be their modular design. It will make us able to adapt their capability to each mission while keeping the cost low.

Of course we will rely on AI in order to control these systems in a highly automated manner and provide teaming or even swarming functionalities.

Would it be possible to define in a few words what the Combat Cloud concept is?
The Combat Cloud can be seen as a shared information space where an ocean of information and data is managed efficiently, giving the NGWS the power to operate all available platforms in a network-based manner. The true added value of this Combat Cloud lies in its ability to provide collaborative combat services across domains. Its key features are: LPI/LPD (Low Probability of Interception/Low Probability of Detection) data links, edge com-

Figure 4 : Remote Carriers (RCs) – © DGA - NGWS Combined Project Team

puting, AI-based user services and cybersecurity.

How will this extremely difficult Phase 1B-2 be conducted?
Phase 1B-2, the demonstration phase, will be managed by parts.
Such a "by parts" concept mitigates the risks and favours innovation. So, Phase 1B-2 will be conducted in a 7-Pillar approach (Figure 5):
PILLAR 1 is NGFD – New Generation Fighter Demonstrators - Studies related to the aircraft airframe will particularly focus on bringing robustness to the manoeuvrability vs low observability trade-off. Two demonstrators will be developed: one ground demonstrator to validate the stealth performance (low observability), and one flight demonstrator.
PILLAR 2 is ENGINE – This relates to the engine of the operational New Generation Fighter. All modules will be deeply studied: intake, LP and HP compressors, LP and HP turbines, nozzle, etc. Several ground demonstrators will be realised.
PILLAR 3 is RC/MUT – Concerning the Remote Carriers (RC), two types are to be distinguished: type 1 the small Unmanned Air Vehicles, considered as expendable components, and type 2 the large Unmanned Air Vehicles, acting as loyal wingmen
PILLAR 4 is CC – Here several Ground Demonstrators will be developed upon the basis of 'bricks' with a view to validating the whole Combat Cloud.
PILLAR 5 is SIMLAB – Simulation tools called simulation laboratories will be developed to test the right operation of each of the above mentioned pillars.
PILLAR 6 is SENSORS – Here 15 demonstrators are foreseen: one dedicated to the sensor suite which will be tested in flight and others related to the individual sensors which will be tested on ground.
PILLAR 7 is ELOT (Enhanced Low Observability Technology) – This pillar will aim at ground testing several low observability features.

In parallel we will keep working on the operational NGWS concepts. We will carry out operational analysis and evaluation campaigns by simulation and we will do that at different levels. At L0 level, meaning at SoS level, to downselect the best NGWS architecture or combination. At L1 level to downselect the best concept for each of the assets. And at L2 level to refine the architectures of the different subsystems like engine or sensors…

In addition, the Work Packages will have to be perfectly coordinated at the interface between 2 Pillars: 20 "mirror work packages" have been determined.

How is organised the sharing of responsibilities between all industrial companies involved?
The industrial set up for Phase 1B is governed by three key principles: clear allocation of responsibilities and leadership, direct access to the customer for all stakeholders, full visibility for all stakeholders. The overall management of the Operational and Conceptual Studies is assigned to 3 Prime Contractors: Dassault Aviation (France), ADC GmbH (Germany) and INDRA (Spain). Each of the 7 Pillars is assigned to Prime Main Partners as indicated in *figure 5.*

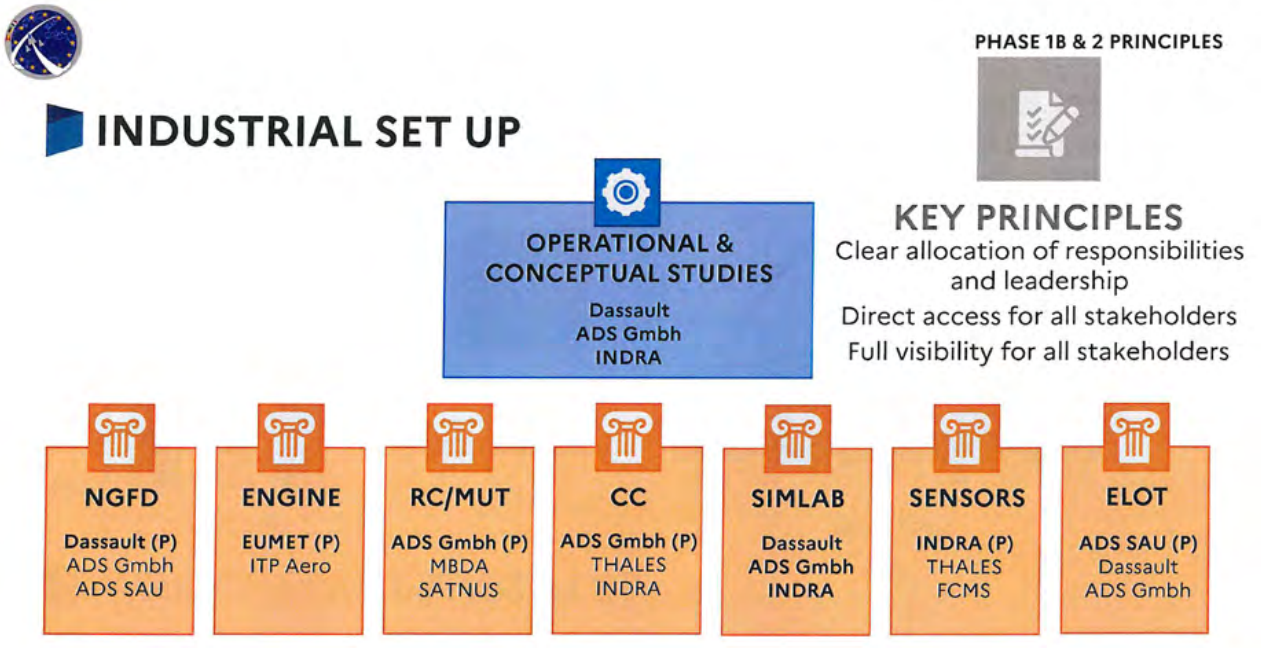


Figure 5 : Industrial Set Up – © DGA - NGWS Combined Project Team

Could you say some words about the governance of the project?

The governance of the project was agreed in the Framework agreement signed in June 2019.

The Combined Project Team (CPT) I am sitting in acts directly under the command of the NGWS Steering Committee, which is the decision level. We are the implementing level of the project, which means that we represent the customer party in front of the Representing the customer means that the CPT is providing the companies with a single position, and not 3 national views. That's the crucial role of the CPT: harmonizing the different positions of Germany, Spain and France, in order to find the best acceptable consensus.

The CPT is composed of two main divisions :

- The Programme Division is especially in charge of the management, negotiation and preparation of the contracts in close link with the French DGA. It is also responsible for the technical, financial and security matters.
- The Operational division is taking care of the good understanding and good consideration of the operation needs and operation requirements of the 3 partner nations by all the stakeholders

The CPT staff is already 30 persons it should increase to 40 by the end of the year.

Is NATO involved in the NGWS programme?

NATO is not directly involved in the NGWS programme. However we must work on standardized interfaces to ensure interoperability with other NATO assets.

What about the future possible links between the Tempest Programme and the European NGWS?

We already work, since 2019, on bricks of interoperability between both projects and the EDF (European Defence Fund) project 'EICACS' (European Initiative Collaboration Air Combat Standardisation) which was just initiated under Dassault Aviation leadership will also involve some Tempest project representatives (e.g Leonardo) which will give us opportunity to work altogether on standardized interfaces.

In conclusion how would you express very briefly the main challenges you are facing?

Phase 1B contract award is already a tremendous achievement but we have still many challenges that lie ahead.

On the cooperation side we will have to enhance trust and mutual understanding between teams and between nations. It will be key to take the most critical future decisions and especially the ones necessary to agree on an efficient organization.

On the technology side, the step is very high to achieve the necessary level of maturity on all key technologies and to federate an innovative ecosystem.

On the operational side, we will have to harmonize our needs between nations while taking the most benefit of this collaborative combat concepts.

Last but not least, on the ways of working, we will have to leverage the digital and simulation tools to handle the complexity of NGWS.

INTERVIEW WITH PHILIPPE BERTHE, ESA

By Jean-Pierre Sanfourche, Editor in Chief

FOLLOWING ARTEMIS I: ARTEMIS II – ARTEMIS III – I-HAB – ESPRIT - ERSA

***Philippe Berthe** is the Project Coordination Manager, ORION-ESM Programme at ESA.*

The Artemis I mission concluded its successful 25-day duration trip to the Moon and beyond with the perfect splashdown of the Orion spacecraft in the Pacific Ocean on 11 December 2022. Since this date, a high number of data analyses are being performed. Could we summarize the present balance of them, more especially those related to the European Service Module? More globally, what are the major lessons learnt from this first Artemis mission?

It's not possible to provide a comprehensive summary of the data analysis from the Artemis I mission, as it's an ongoing process which will last till the end of March 2023 and the results are yet to be fully published. However, the European Service Module (ESM) was an essential component of the Orion spacecraft and reportedly performed as expected during the mission, providing propulsion, power, and thermal control for the crew module. Indeed, it performed globally better than expected, the solar array wings provided more power than expected, the propulsion used less propellant than expected, etc.

As for the major lessons learned from the Artemis I mission, it's important to note that it was an uncrewed test mission designed to demonstrate the capabilities of the Orion spacecraft and the ESM, as well as to pave the way for future crewed missions to the Moon. Some of the key objectives of the mission included testing the spacecraft's navigation and guidance systems, evaluating the performance of the ESM, and gathering data on the deep space environment to inform future missions. The major point is that now we have a vehicle which capable of carrying out a crewed mission, so humankind has again the capability to send humans beyond Low Earth Orbit.

In conclusion, the Artemis I mission was a crucial step towards establishing a sustainable human presence on the Moon, and the data and insights gathered from the mission will inform future missions and help to advance our understanding of deep space.

What are the ESM performance analyses remaining to be achieved with a view to preparing Artemis II?

An ongoing review of data from the Artemis I mission has turned up no issues that would delay the crewed Artemis II mission for launch late next year. In March 7 briefing, NASA managers said that anlysis of data from the Space Launch System, Orion spacecraft and ground systems had found only minor issues that can be addressed ahead of Artemis II (see details in page 32).

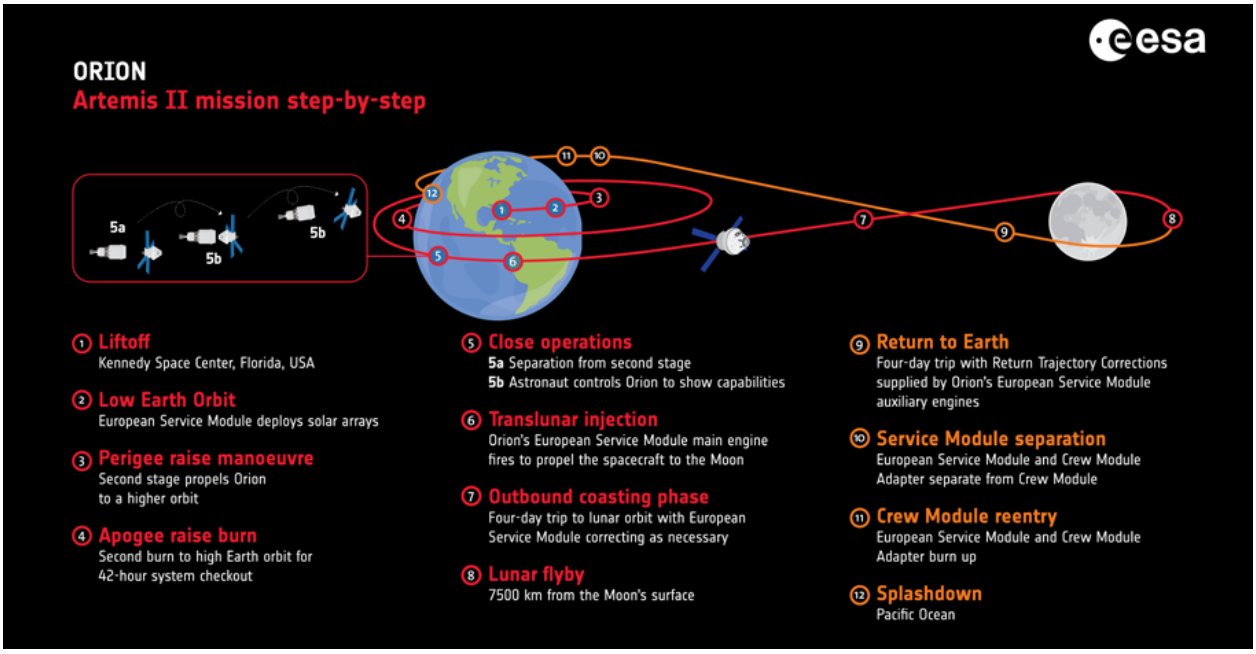
The Artemis II mission will continue to test the functionality of the whole system during this time during a crewed flight. Would it be possible to review its main specifications?

Artemis II step by step :

- **Launch date.**
- **Mission duration and objectives.**
- **The step-by-step trajectory.**
- **Crew composition and missions (operations and science & technology activities) – Will a European astronaut be part of the crew?**
- **Main differences between the ESM of mission I and ESM of mission II: new elements and new roles (thrusters, life support to crew, etc.).**

The launch date is second semester of 2024. The mission duration is about 10 days and the objectives are to perform a crewed mission around the Moon, to validate the life support of Orion, to validate the human machine interface of Orion, to perform a rendezvous with the SLS upper stage (ICPS) after separation and once in High

Orion and European Service Module



Artemis II step by step

Earth Orbit, and to validate all crew operations in flight and on ground (before or after flight).
The description of the mission is available at the following URL https://www.esa.int/Science_Exploration/Human_and_Robotic_Exploration/Orion/Artemis_II

ARTEMIS II STEP BY STEP

- Launch by Space Launch System from pad 39B, Kennedy Space Center
- Mission control perform checks in low-Earth parking orbit
- Perigee Raise Manoeuvre: injection into elliptical high Earth demonstration orbit by Interim Cryogenic Propulsion Stage 40 minutes after lift-off
- Apogee Raise Burn by Interim Cryogenic Propulsion Stage
- 42-hour checkout period of systems (orbit of 185 km at closest point to Earth and 2600 km at farthest point)
- Interim Cryogenic Propulsion Stage disposal
- Translunar injection by Orion
- Trip to the Moon
- Flyby of the Moon
- Free-return trip to Earth (no engine firing required)
- Separation of the Crew Module from the expendable elements of Orion (the European Service Module and the Crew Module Adapter)
- Re-entry of the Crew Module and splashdown in the Pacific Ocean

The crew composition will be three NASA astronauts and one CSA astronaut. No ESA astronaut is foreseen for this mission. First mission with ESA astronaut is tentatively Artemis IV.

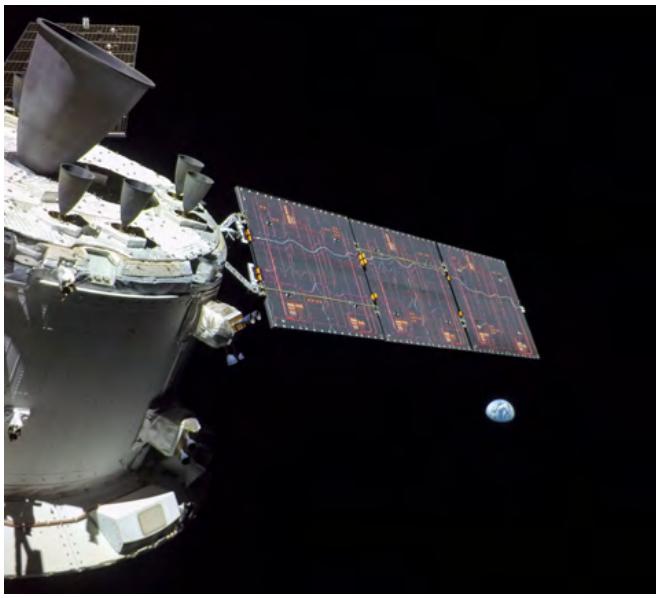
What is the present status of Artemis II mission's preparation?

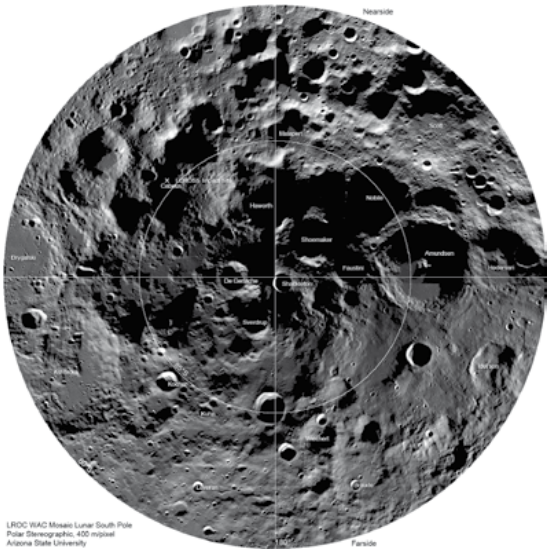
The ESM-2 is in NASA KSC, It has been integrated with its adapter and is being equipped and tested in view of its integration with the Crew Module. Next test foreseen is acoustic testing or DFAT.
The CM-2 is also in KSC and his being outfitted with its equipment and heat shield.
The SLS-2 Core Stage is completing integration in Michoud and should arrive in KSC this spring.

Is the European Astronaut Centre (ESA/EAC) involved in the preparation of future Lunar missions?
For the Artemis missions, the European Astronaut Centre (ESA/EAC) will be involved once European crew members are selected, so probably from the point when Artemis IV crew will be assigned, probably two or three years before the mission.
Meanwhile, the European Astronaut Centre supports the design studies for the European contributions to the Gateway and in particular I-Hab, the habitation module of the Gateway which will be delivered to the outpost by Artemis IV.

Following the two first Artemis missions to learn the capabilities of the Orion spacecraft, Artemis III mission is all about landing astronauts on the Moon. Its launch is expected to take place in 2025, so I think it is opportune to provide our readers as of now with an overview of this historical mission:

- **Date and primary objectives;**
- **Step-by-step trajectory;**
- **Crew composition, operational and science & technology research activities;**
- **Landing on the Moon process with the SpaceX Starship Human Landing System (HLS);**





ESM and the Orion spacecraft

- **ESM's new components and capabilities;**
- **New ESA involvements.**

The launch date is the end of 2025. The mission duration is about 3 weeks including six days on the surface at the South Pole of the Moon and the objectives are to perform the first landing on the Moon since 1972. In particular, the mission will validate the rendezvous and docking in NRHO by Orion, the behaviour of the Orion / Starship HLS composite, the Starship HLS with a crew on board, and the ascent from the surface by the Starship HLS.

The description of the mission is available at the following URL https://www.esa.int/Science_Exploration/Human_and_Robotic_Exploration/Orion/Artemis_III

ARTEMIS III STEP BY STEP

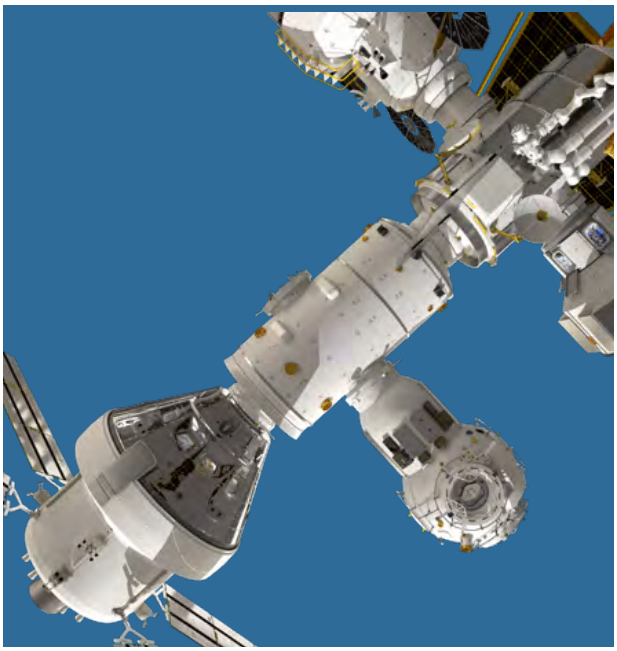
- Launch by Space Launch System from pad 39B at NASA's Kennedy Space Center, USA
- Mission control perform final checks in low-Earth orbit
- Translunar injection by interim cryogenic propulsion stage (ICPS)
- Trip to the Moon
- Flyby of the Moon with gravity assist
- Arrival at Near Rectilinear Halo Orbit
- Docking with Starship

Orion Splash down

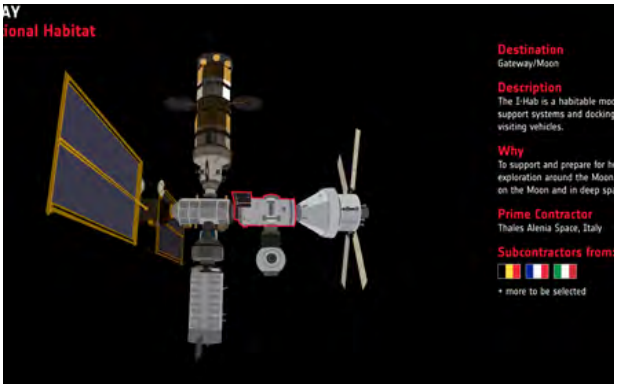
- Transfer of equipment and astronauts
- Undocking from Starship and Starship landing on the Moon
- Orion does 6-day complete orbit of Moon as two astronauts work and explore the lunar South Pole.
- Liftoff of Starship from the Moon
- Docking with Orion
- Transfer of supplies and setup for home trip to Earth
- Undocking from Starship
- Departure from Near Rectilinear Halo Orbit
- Main engine fires for lunar gravity assist
- Homeward cruise
- Separation of the Crew Module from the expendable elements of Orion (the European Service Module and the Crew Module Adapter)
- Re-entry of the Crew Module and splashdown in the Pacific Ocean

The ESM-3 ESM will benefit from various improvements with respect to ESM-2, in particular a new Thrust Vector Control for the main engine, developed by NASA and Lockheed, and various improvements of the Propulsion system such as new types of valves and modified canting of the Reaction Control System thrusters.
The crew composition will be four NASA astronauts. No ESA astronaut is foreseen for this mission. First mission with ESA astronaut is tentatively Artemis IV.

In conclusion could you say a few words about the role of ESA in Artemis IV, V and VI missions with notably the, the Gateway, the ESA i-HAB and the ERSA (European Radiation Sensor Array)?
The European Space Agency is a significant player in the Artemis IV, V, and VI missions, which are part of NASA's larger Artemis program to return humans to the moon. The ESA is contributing several key elements to the missions,



I-Hab on Gateway



The I-Hab

including supplying European Service Modules for these three missions.
The Gateway is a planned lunar orbiting platform that will serve as a staging point for future moon missions. The ESA is contributing through i-Hab and Esprit.
i-HAB (International Habitation Module): The i-HAB is a planned habitation module for the Gateway that will provide a living and working space for astronauts. The ESA is leading the development of this module in collaboration with international partners. It will be launched with Artemis IV. The prime contractor is Thales Alenia Space.

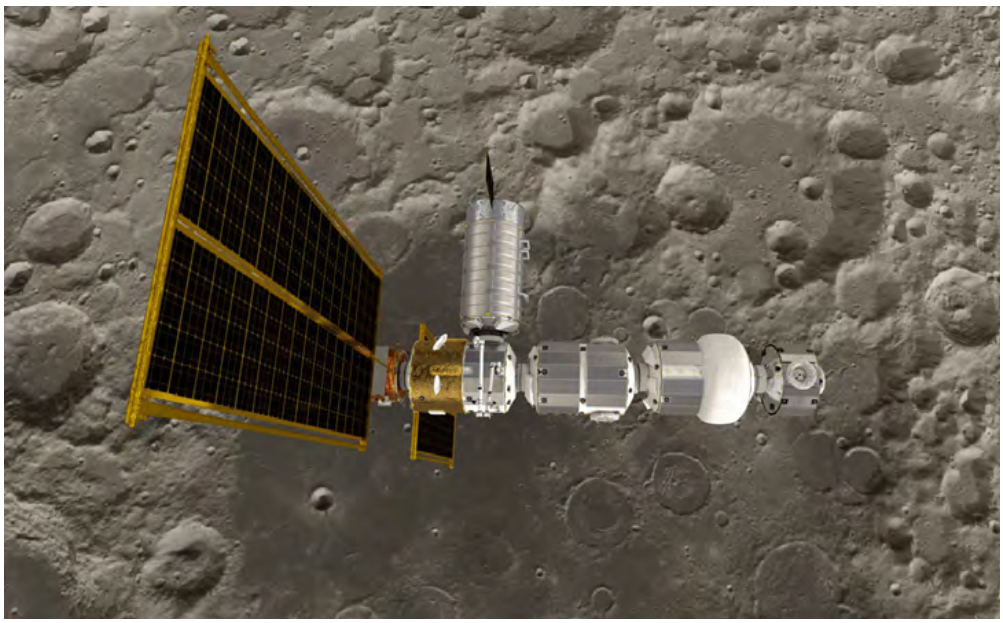
Gateway with ESPRIT module right

For details see:
https://www.esa.int/Science_Exploration/Human_and_Robotic_Exploration/Gateway_International_Habitat

ESPRIT

The ESPRIT Refuelling Module (ERM) has four main functions: transport cargo to the station, provide storage space once docked at Gateway, provide fuel to propulsion system of Gateway (NASA's Gateway Power and Propulsion Element), and provide a view of space and the Moon through its windows. It will be launched with Artemis V. The prime contractor is Thales Alenia Space in Cannes, France.
For details see:
https://www.esa.int/Science_Exploration/Human_and_Robotic_Exploration/Gateway_ESPRIT

ERSA (European Radiation Sensor Array): The ERSA is a suite of radiation sensors that will be flown on the Ga-



ERSA, ESA's experiment to monitor radiation in deep space.

teway to measure the radiation environment around the moon. This information is important for understanding the potential health risks to astronauts during long-duration missions. The ESA is providing the ERSA for the Gateway.

* *For details see:*
https://blogs.esa.int/exploration/artemis-introducing-ersa-european-experiment-to-monitor-radiation-in-deep-space/

Overall, the role of the ESA in the Artemis missions is to provide key technology and expertise to support the exploration and habitation of the moon.

ABOUT ISSUES FROM ARTEMIS I MISSION:

– The biggest issue was with the heat shield on the Orion crew capsule: material on the heat shield had ablated differently than expected from ground tests and computer models. But the difference in performance is not a safety issue because a significant amount of margin is left over.
– Work is continuing on an issue with the powr system on Orion's service module called a latching current limiter, which opened without being commanded two dozen times during the mission. ESA and Airbus are planning a test in the coming days to better understand what caused the uncommanded events, such as electromagnetic interferences.
– Ground systems engineers are fixing damage to the mobile launcher from the SLS launch. The elevators in the mobile launcher tower were knocked out of commision, but one is now back in service.

GLOSSARY

- **CM:** Crew Module
- **CMA:** Crew Module Adapter
- **ERM:** ESPRIT Refuelling Module
- **ERSA:** European Radiation Sensors Array
- **EAC:** European Astronaut Centre of ESA
- **ESM:** European Service Module
- **ESPRIT:** European System Providing Refuelling Infrastructure and Telecommunications
- **HEO:** High Earth Orbit
- **HLS:** Human Landing System
- **ICPS:** Interim Cryogenic Propulsion Stage (upper stage of the SLS)
- **I-Hab:** International habitat
- **KSC:** Kennedy Space Center (Cape Canaveral, Florida)
- **NRHO:** Near Rectilinear Halo Orbit
- **SLS:** Space Launch System ('Mega Moon Rocket' of NASA)
- **Starship:** fully reusable super heavy-lift launch vehicle developed by SpaceX

NASA UNVEILS ARTEMIS MOON ASTRONAUT CREW TO FLY IN 2024

NASA has named its first astronaut crew bound for the moon in more than 50 years: the Artemis 2 crew.
The Artemis 2 crew includes commander Reid Wiseman, pilot Victor Glover and mission specialists Christina Koch (all of NASA) and Jeremy Hansen of the Canadian Space Agency. Here's what they'll do**. Full Story**: Space

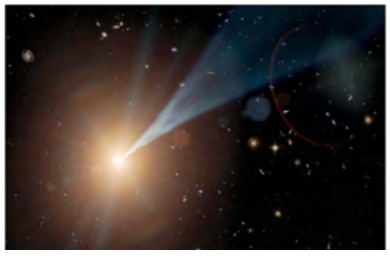
© *NASA*

LIVE UPDATES FOR NASA'S ARTEMIS 2 MOON MISSION

Here's the latest on NASA's Artemis 2 moon mission to send four astronauts on a lunar trek in 2024. **Full Story**: Space

ASTRONOMERS SEE BLACK HOLE JET CHANGE DIRECTION FOR FIRST TIME

For the first time, astronomers have spotted a jet blasting from the core of a distant galaxy that has changed directions and it's aimed right at Earth. **Full Story**: Space



© *NASA/JPL*

APRIL NIGHT SKY DELIGHTS: MERCURY, VENUS AND PLEIADES

From now through mid-April, in the western evening twilight sky, the "Queen of the Night," better known as the brilliant planet Venus, will help you to identify the normally hard-to-find planet Mercury. **Full Story:** Space

WHY WON'T NASA'S ARTEMIS 2 ASTRONAUTS ORBIT THE MOON?

Artemis 2 will be the first time NASA has sent humans to the moon in over 50 years, and a lot has changed since then. But unlike Artemis 1, it won't enter lunar orbit. There's a good reason for that. **Full Story**: Space

ARTEMIS 2 CANADIAN ASTRONAUT GOT SEAT WITH "POTATO SALAD"

It took four years of negotiations for Canada to get a seat on NASA's upcoming moon mission.
The Canadian seat comes courtesy of a big contribution to NASA's Artemis program: Canadarm3, a robotic arm that will service the planned Gateway moon-orbiting space station. But also, a tasty side dish? **Full Story**: Space

© *CSA/NASA*

SPACE X STARSHIP WILL LAUNCH PRIVATE MOON ROVER IN 2026

California-based Astrolab has reached an agreement with SpaceX to launch its Flexible Logistics and Exploration (FLEX) rover on an upcoming Starship mission to the moon. Astrolab is planning to operate an entire fleet of FLEX rovers on the lunar surface. **Full Story:** Space

PRIVAT MOON ROVER TO LAUNCH BITCOIN TREASURE HUNT

Cryptocurrency is going to the moon. A wallet key for $1.5 million in Bitcoin will be attached to Lunar Outpost's MAPP moon rover and can be claimed by the first private moon traveler to find it. **Full Story**: Space

WHAT'S NEW IN THE ESA ACADEMY PROGRAMME?

10/03/2023

The **ESA Academy programme** (18+ y/o) is to complement the education of young adults to enhance their competencies and skills and eventually increase their employability in the space sector and beyond. With the evolved ESA Academy, we will maintain core heritage elements such as the highly qualifying training model based on courses and project-based learning for university students studying STEM subjects, but we are going to offer much more.

- We are adding training models to our portfolio, including challenges, hackathons, projects on downstream space applications and a more flexible approach to the use of our experiments and satellite platforms
- We are introducing new training methods, such as e-learning and highly qualifying interdisciplinary trainings, also for a more personalised learning experience
- We are adding new audiences: technicians (e.g. professional bachelors, vocational training), students and graduates from non-STEM backgrounds (business, law, agriculture, architecture, and more), and in the future also young graduates and early-career professionals
- We will cover additional subject domains and topics such as cybersecurity, AI, coding, climate & environment, space safety & security, quantum science and technologies, downstream & business applications, etc
- We are setting structured engagement models with academia and industry, and with all areas of ESA expertise, to achieve both training objectives but also higher inspiration and engagement levels
- We aim at offering more opportunities, for a considerably higher number of participants.

THE AIRBUSINESS ACADEMY

AirBusiness Academy develops and nurture the knowledge, skills and behaviours of professionals within and beyond the aerospace industry, worldwide.
AirBusiness Academy has been committed to developing professionals in aeronautics and gaining insight into the management needs of the talents working in this operational processes and tools.

TALENTS DEVELOPMENT

Management skills for individuals and teams in order to optimise business processes, methods, tools and quality standards in the aerospace industry
As an Airbus company, the differentiating factor is the close proximity to the aeronautical world. AirBusiness Academy draws its knowledge and expertise directly from the industry experience of Airbus which allows have an excellent grasp to hot topics in the industry and current issues facing professionals involved throughout the complete aeronautical value chain.
Within the learning portfolio: training facilitation, coaching and consulting services to develop management skills and a range of modern hands-on methods of transferring know-how such as business simulations, on-the-job auditing, serious gaming, virtual classrooms, e-learning, etc.

TALENTS DEVELOPMENT DOMAINS:

Developing management skills for individuals and teams in order to optimise business processes, methods, tools and quality standards in the aerospace industry

INTRODUCTION
As an Airbus company, our differentiating factor is our close proximity to the aeronautical world: we draw our knowledge and expertise directly from the industry experience of our mother company. This allows us to have an excellent grasp of hot topics in the industry and current issues facing professionals involved throughout the complete aeronautical value chain.
Within our Learning portfolio, you will find training, facilitation, coaching and consulting services to develop management skills and a range of modern, hands-on methods of transferring know-how such as business simulations, on-the-job auditing, serious gaming, virtual classrooms, e-learning, rich media...
Solutions can be delivered off-the-shelf, customised as requested or developed specifically for your needs.
The Learning faculty blends learning techniques, design expertise, serious gaming approaches with hard and soft skills to create pertinent solutions within the below domains.

- Aviation operations
- Aviation Strategy & Finance
- Procurement & Supply Chain
- Operational Excellence
- Programme and Project management
- Leadership

ORGANISATIONAL DEVELOPMENT

KNOWLEDGE MANAGEMENT SOLUTIONS

- **Ensuring that expertise and talent remain in the business**

VALUING KNOWLEDGE AS A COMPANY ASSET
Knowledge Management is a set of methods and techniques that allows an organisation to identify, analyse, capture, structure and share the knowledge from within in order to enhance its performance and competitiveness and hence truly value employees.
If you need support in retaining knowledge in your team or organisation, in situations such as mobility, retirement

or prolonged absence for example, our dynamic team can accompany you using a set of proven solutions or by designing the perfect customised solution to meet your needs.

YOUR BUSINESS CHALLENGES
- Prevent expertise and knowledge loss
- Reduce collective knowledge gap
- Map critical knowledge within the organisation
- Capture the appropriate gestures for the performance of critical tasks
- Capture lessons learnt to capitalise on best practices

INNOVATION & COLLABORATION SOLUTIONS

- **Fostering collaboration throughout organisation**

Our mission

We aim to design and deliver inspiring experiences, to foster innovation and facilitate business transformation, building on our clients' full potential.

For us, business transformation is the journey to align People, Processes and Technology initiatives to support and create new business strategies.

In order to foster success and well-being, the AirBusiness Academy team focuses on five key working principles
- customer needs focus
- excellence and great designs
- fail fast and learn
- collaboration and cooperation
- direct communication

LEADING INNOVATION

- **Placing agility at the centre of how you operate as an individual, as a team and as a business**

Companies remain competitive in a context driven by uncertainties, rapid evolution of technology and changing consumer behaviours balancing innovation and operational excellence. These conditions require placing strategic thinking, innovation thinking and intrapreneurship at the centre of how we operate as an individual, as a team and of course, as a business. This blended programme combines elearning and virtual group activities to focus on behavioural and mindset growth.

Who should attend?
- Intrapreneurs, innovators and leaders that need to embody the company vision and that are in charge of creating the conditions to boost innovation

Pre-requisites:
- No pre-requisite

Objectives:
- Understand the key elements and how to set-up a company strategy in a VUCA environment
- Develop entrepreneurial behaviours and attitudes to operate under conditions of high uncertainty
- Be equipped with customer-centric processes and tools in order to leverage innovation for business growth and sustainability
- Develop a creative and collaborative mindset to better seize emerging opportunities and lead ideas to successful commercial ventures
- Understand the obligation to innovate and know how to successfully build a culture of innovation

Duration:

Three half days

Course content:
- Definition of company vision, mission and values
- Establishing strategy and practicing related tools
- Creativity tool to develop a customer-centric approach
- Skillset on critical thinking
- How to launch ideation sessions
- Implementing an end-to-end process

Methods and evaluation:
- Session in English - Contact us to arrange a session in another language
- Theory delivered in classroom
- Practical activities through serious game / use-case study
- Continuous control through practical activity

TO JOIN AIRBUSINESS ACADEMY

https://www.airbusiness-academy.com/en/11-join-our-team.php

THE 53RD BOARD OF TRUSTEES MEETING AND THE ANNAUL GENERAL ASSEMBLY

By Andrea Alaimo, DG of CEAS

The 53rd Board of Trustees Meeting and the annual General Assembly of CEAS was held in Noordwijk the 23rd of November 2022 and was hosted by ESTEC thanks to the great support of Mrs Britta Shade (CEAS Space Branch Chair) and Mr. Johan Steelant (CEAS Space Journal Managing Editor).

It was a very busy day that started with the General Assembly and in particular with the annual report from the CEAS President, Mr Franco Bernelli Zazzera. He gave a summary on the meetings which were held in 2022, highlighting that after the long period of Covid pandemic, CEAS was able to organize on site meetings again starting from the one held in Madrid, Spain on 14th of June during IFSAD Conference and the CEAS Board of Trustees meeting which was held on 6th of September during ICAS Conference in Stockholm, Sweden.

Mr Bernelli also reminded about all the conferences in 2022 where CEAS was involved, either directly organising or supporting the events such as the Joint Event with Korean Society of Aeronautical and Space Sciences which was held in Jeju, Korea on 16 -18th of November during which a special international session KSAS – CEAS was held on 16th of November with 5 abstracts from the CEAS community. The other conferences that involved CEAS were:

- EuroGNC Conference (Guidance, navigation and Control,) held in Berlin (Germany) from 3 to 5 May;
- IFASD, the 19th International Forum on Aeroelasticity and Structural Dynamics, held in Madrid (Spain) from 13 to 17 June;
- 48th European Rotorcraft Forum which was held in Winterthur (Switzerland from 6 to 8 september;
- HiSST - 2nd International Conference on High-Speed Vehicle Science and Technology, held in Bruges (Belgium) from 12 to 15 September.

Mr Bernelli also informed that the process of the awards has been restarted by assigning both the Gold and the Distinguished Service Awards as well as the most cited Papers Award.

Last but not least, Mr Bernelli underlined that during 2022, CEAS established good relations with EUCASS which resulted in a joint organisation of Aerospace Europe Conference in 2023 - a new challenge for CEAS.

During the CEAS General Assembly there were some changes among the Trustees. More particularly, Mrs Dominique Nouailhas has replaced Mr. Pierre Bescond for 3AF while Mr José Manuel Hesse became a new Trustee for AIAE replacing Mrs Estefania Matesanz.

From the Board of Trustees Meeting no turnover has instead been encountered for the CEAS President. Mr Bridel, on behalf of the Council of Past Presidents, thanked Mr Bernelli for his presidency, underlined his commitment in CEAS activity and shared the opinion of all the past presidents which are in favour of seeing Mr Bernelli as the CEAS President for the next year as well.

With regards to the Offices of Vice Presidents, Mrs Nouailhas has been elected a new Vice-president for External Relations & Publications without any objections. One of the main issues discussed during the Board of Trustees meeting was related to CEAS IT Infrastructures. CEAS, in fact, has equipped itself with an IT tool for the management of Conference registration and payment. This tool was properly updated for being used for the upcoming AEC conference. Moreover CEAS has re-designed its web site, thanks to the IT Manager, Mr Thomas Vermin, with the creation of a repository for all the publications related to the CEAS events.

The other main issue of the meeting was the upcoming Aerospace Europe Conference, scheduled on 9-13th of July 2023, in Lausanne. In particular Mr Bernelli informed that the list of the 14 panel's chairs was completed, and that one session will be organized by EASN and one session by EURO Turbo.

Mr Bernelli also informed that CEAS members will pay reduced conference fee.
The call for abstracts for AEC 2023 has been opened on 1st of December 2022 and was recently closed. The reviewing process is planned to be finished inn the end of April 2023.

Lastly but not least, the trustees decided the site and date for the next meeting that will be held at University of Unikore in Enna in Sicily, on 20th of April (Thursday) 2023. So, hope to see you there soon…

AEC2023 LAUSANNE

The Aerospace Europe Conference 2023 is a joint event between the 10th European Conference for Aerospace Sciences (EUCASS) and the 9th conference of the Council of European Aerospace Societies (CEAS).

The objectives in 2023 are to strengthen the link between space and aeronautics, facilitate cross-fertilisation and lay the foundations for a major unified international congress of aerospace sciences in Europe. With rich scientific content for the future of space and aeronautics, the Aerospace Europe Conference 2023 will present cutting-edge ideas for the world of tomorrow.

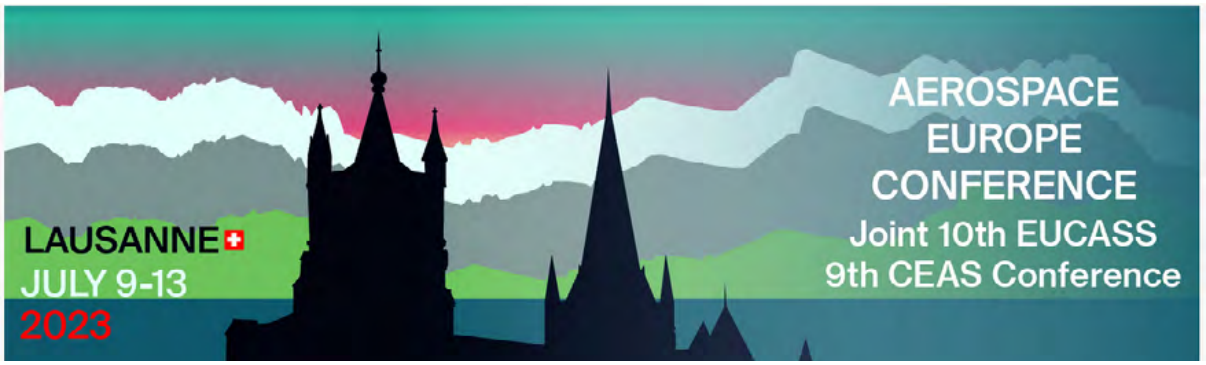
Organised at the Swiss Tech Convention Center in Lausanne, Switzerland, the conference will also be an opportunity to discover the city, the Olympic Capital of the world, as well as the Swiss Federal Institute of Technology ranked 16th in the QS World University Ranking.

TARGET AUDIENCE

This is the tenth EUCASS conference after Moscow (2005), Brussels (2007), Versailles (2009), Saint Petersburg (2011), Munich (2013), Krakow (2015), Milano (2017), Madrid (2019), Lille (2022) and the the nineth CEAS conference after Berlin (2007), Manchester (2009), Venice (2011), Linkoping (2013), Delft (2015), Bucharest (2017), Bordeaux (2020), Warsaw (2021).

Aerospace Europe Conference 2023 will attract research scientists, engineers, managers and decision makers from all over the world, coming together. It positions itself as a bridge between science and applications at the service of agencies, industry and society. It strives to reduce the delay between discoveries in academic laboratories and applications for its end users: industry, agencies and public policy. It provides an excellent opportunity for exhibitors to demonstrate expertise, products and services to a targeted group of researchers, scientists, engineers and senior managers. Customized Sponsorship packages will be available to allow for brand positioning throughout the event.

AEC2023 LAUSANNE



IMPORTANT EXHIBITOR INFORMATION FOR THE AEROSPACE EUROPE CONFERENCE 2023

Dear participants,

We are pleased to announce that we have already received more than 650 abstracts from 41 countries for the Aerospace Europe Conference 2023. If you would like your company or organization to have a stand at this well-attended event, please note this important modification concerning the offer for exhibitors:

The rental of a 6m^2 equipped and space only booth includes a full registration for one person, with access to the scientific sessions, the get-together party on Sunday evening, the welcome party on Monday evening, coffee breaks and lunches for the four days, and a gala dinner ticket.

The rental of a 12m^2 equipped booth and space only booth includes full registration for three people, with access to the scientific sessions, the get-together party on Sunday evening, the welcome party on Monday evening, coffee breaks and lunches for the four days, and a gala dinner ticket.

This will also apply to members who have already booked their booths. The prices for the booth spaces only (no shells) have been adapted. As a reminder, please see below for the early-bird prices to become an exhibitor (until April 30).

Space only fees:More Informations

		6 Sqm	12 Sqm
NORMAL BOOKING CHF.-500,00/ Sqm	Before April 30th, 2023	CHF.- 2'085,00 VAT incl.	CHF.- 5'316,00 VAT incl.
LATE BOOKING CHF.- 600,00/ Sqm	May 1st to May 31, 2023	CHF.-2'731,00 VAT incl.	CHF.-6'608,00 VAT incl.

Space + stand fees:

		6 Sqm CHF.- 400/ M2	12 Sqm CHF.- 450 M2
NORMAL BOOKING	Before April 30th, 2023	CHF.- 2'585,00 VAT incl.	CHF.- 5'816,00 VAT incl.
LATE BOOKING	May 1st to May 31 2023	CHF.- 3'231,00 VAT incl.	CHF.- 7'108,00 VAT incl.

Become an exhibitor

About the Aerospace Europe Conference 2023:

The Aerospace Europe Conference 2023 is a joint event between the 10th European Conference for Aerospace Sciences (EUCASS) and the 9th conference of the Council of European Aerospace Societies (CEAS). The objectives in 2023 are to strengthen the link between space and aeronautics, facilitate cross-fertilisation and lay the foundations for a major unified international congress of aerospace sciences in Europe. With rich scientific content for the future of space and aeronautics, the Aerospace Europe Conference 2023 will present cutting-edge ideas for the world of tomorrow.

Register now

Thank you and we look forward to seeing you in Lausanne for the Aerospace Europe Conference 2023!

Kind regards,
The EUCASS-CEAS Technical Team

AIR AND SPACE ACADEMY CONFERENCE ON SPACE EXPLORATION
MAY 10-12, 2023, TURIN

By Eric Dautriat, Vice-President, Air and Space Academy

The Air and Space Academy (AAE) organises an annual conference on various topics. The 2023 conference will be dedicated to Space exploration, both automated and manned, which is back on the agenda in many strategic reflections and long-term programmes.

The recent launch of STS-1, part of the Artemis programme, which took the Orion capsule to the Moon, showed that the process of sending men and women back to our satellite is now on track. Once again, Europe is involved, for example by providing the Orion service module. Chinese missions are also showing the same ambition. Other countries around the world are also increasingly involved in exploring the Solar System. Robotic missions are flourishing too – Mars remains one of the most enticing targets, but the giant planets are also on the stage: the penultimate Ariane 5 launcher is about to send the ESA JUICE mission to Jupiter's icy moons. Recently, the ESA Directorate General convened a "High-Level Advisory Group for Robotic and Human Exploration".

The AAE conference is being held at Politecnico di Torino, with the support of this university, of AIDAA (the Italian aerospace association and CEAS member) and of Space Generation Advisory Council (a broad, international organisation of young engineers and students from the space sector). It is aimed at agency decision makers, professionals and, in particular, students, but also at the general public interested in the human adventure of exploring the Solar System. The programme committee is chaired by Jean-Jacques Dordain, former Director General of ESA and AAE member.

AAE conferences follow a linear sequence; there are no parallel sessions – this allows the audience to attend all presentations and panels. Consequently, the number of subjects addressed is more limited and these are more focused. For Space Exploration, the aim is to limit the scope to a few important themes rather than trying to cover the full scope of Exploration – an impossible task anyway! - or discussing programmatic issues, which are under the control of agencies or other relevant bodies. This should allow this conference to encourage as useful input and opinions as possible. A summary document with Recommendations will be issued in the wake of the conference – as is usual for AAE events.

Two keynote speeches will be given by ESA Director General Josef Aschbacher and astronaut Samantha Cristoforetti, while Francis Rocard, in charge of Exploration programmes at CNES, will give an overview of current and future programmes worldwide. There will also be a high-level panel comprising a representative of the ESA's High Level Advisory Group along with national programme representatives and industry leaders.

Seven topics have been selected, because they are often under-represented in space policies, while fundamental to many, if not all exploration projects. Speakers will come from Europe of course, but also from further afield, such as the US and China, since exploration is clearly an international matter.

The conference is organised around three overarching themes, containing 7 sessions:

- Underlying motivations and first human steps, which will explore the Philosophy and cultural motivations of exploration, Dream missions and Lunar exploration;
- Implementation means, including Flying machines and Going faster (and further);
- Grand objectives: exploring Water, the quest for "oases", and Humans and robots.

Indeed, exploring space is not just one more human endeavour, nor is it just another playing field for science. It is all that, for sure, but it also has very strong specificities. What are the deep motivations, in the anthropological sense, of automated and above all human space exploration? Where does the public interest in this endeavour stem from? Beyond scientists' own motivations, what makes so many human beings, and societies, so enthusiastic about space travel and discovery? Astronauts, scientists, sociologists, will be asked to put these questions into a long-term perspective.

Of course, the human adventure, human dreams are a very strong motivation to "look up" and to question the Universe, and closer to home, our Solar System. Dreams can also be concretized into futuristic missions. Out-of-the-box ideas are carried by the younger generation. This is why "Dream Missions" were the subject of a call for proposal organised by SGAC: the selected ideas will be presented at the conference. They may concern scientific objectives, technical means or even legal or political frameworks for the future. These presentations will be followed by a panel discussion involving both young and "not-so-young young" players.

One of Europe's main areas of concern is the environment. This concern should not be limited to Earth. It is a general philosophical attitude. Environmental issues are also relevant to lunar exploration and possible "exploitation". The abovementioned renewed lunar initiatives raise some questions in this field that are not explicitly explained today: how to minimise and manage the waste generated by the lunar gateway and on the Moon? How to limit the risk of proliferation of space debris around the Moon? Will there be important mining areas for water or minerals, and a permanent team on the lunar surface? What about the dust clouds that might be generated by such an activity? Possible biological spores?

Going further than the Moon with automated probes is not new. But to be more efficient in the future, or to explore new bodies, a number of new or improved technological means will probably be needed. Some of those are linked to "flying machines", for bodies with some atmosphere. In the past, balloons and parachute probes have been used. The NASA/JPL Ingenuity helicopter, deployed in 2021 on Mars, is the first "flying machine" to operate successfully. Dragonfly, a rotorcraft, to Titan will follow – and others.

But it is not enough to develop such machines: we also need to be more efficient in the field of space travel: going faster would not only allow us to go further, but also to reach a more acceptable time for a far-reaching mission to deliver results. Flying faster also means having efficient ways of slowing down when you reach your destination. Solar sailing, nuclear propulsion, aerocapture and other far-reaching concepts will be addressed.
There is one ubiquitous subject in this adventure of exploration: water, i.e. the quest for oases in the Solar System. This is about increasing scientific knowledge by trying to obtain in situ data from samples of water, icy blocks or water embedded in rocks (not to mention the link between water and the supposed origins of life). This is also about preparing for the planned human exploration of the Moon and later, perhaps, of Mars. The sustainability of such exploration is entirely dependent on the proximity of water deposits of all kinds that can be processed by robotic means into pure water: to support human life and also to allow energy storage and use. Much research will have to be done before a permanent human base can actually be installed, on the Moon in particular.

Water management will certainly be one of the many topics for human-robot co-operation. Humans and robots should not be pitted against each other, but should be considered as a global system, working together, each with different implications depending on the place to be visited.

Last but not least: there is a kind of leading question involved in space exploration – the search for extra-terrestrial life, past or present. Of course, this goes well beyond the Solar System. Opinions are divided as to the probability that such extra-terrestrial life exists, and indeed as to the likelihood of ever finding it: a debate between two scientists will be organized on this question, which is not only scientific in the strict sense, but also, in a broader sense, philosophical.

As you can see, this conference will address a wide range of issues, and offer different points of view – scientific, technical, legal, philosophical – on Space Exploration as one of the most fundamental – most deeply-rooted in our cultures – of human journeys.

The programme and registration forms are available at the following link:

https://academieairespace.com/space-exploration

2023

AMONG UPCOMING AEROSPACE EVENTS

APRIL

03-07 April – IAA – **8th IAA Planetary Defence Conference** – In cooperation with ESA and the Commission of Geophysics of Austrian Academy of Sciences – Vienna (Austria) – https://atpi.eventair.com/

11-13 April – AIAA – **AIAA Defense Forum** – San Diego, CA (USA) – www.aiaa.org/defense

16-19 April – AIAA – **PhD Days 2023** – 3rd Edition of the Internal Congress of PhD students in Aerospace Science and Engineering – Bertinoro – Emilia Romagna (Italy) – Centro Residenziale Universitario (CEUB) – https:// www.aidaa.it/phd_days2023 - contact: phd-days@aidaa.it

16-21 April – COSPAR – **COSPAR 2023 - 5th Edition of COSPAR Symposium and 45th Scientific Assembly –** Among topics: Space Science with Small Satellites – Singapore – Nanyang Technical University – Contact: cospar@cosparhq.cnes.fr – https://www.cospar-assembly.org

19-22 April – AERO – **Aero Friedrichshafen** – The Leading Show for General Aviation – Friedrichshafen (Germany) - Friedrichshafen Airport – https://www.aero-expo.com

24-28 April – ETC – **ETC15 - 15th European Turbomachinery Conference** – Fluid Dynamics and Thermdynamics – Budapest (Hungary) – https://www.euroturbo.eu

MAY

07-12 May – IAA – **14th IAA Symposium on Small Satellites for Earth Observation** – Berlin (Germany) – https://iaaspace.org/events/

08-12 May – ESA – **First Microwave Week at ESTEC** – Noordwijk (NL) – ESA/ESTEC – https://atpi.eventair.com/

09-11 May – ESA/NASA – **EnVision Venus Science Workshop** – Understanding why Earth's closest neighbor is so different - Berlin (Germany) - https://atpi.eventair.com/

10-12 May – AAE – **International Conference on Space Exploration** – With support of AIDAA, Politecnico de Torino and SGAC – Turin (Italy) – Turin University – https://academieairespace.com/space-exploration/

20-22 May – ECOMAS – **CM3 – TRANSPORT 2023 – Computational Multiphysics, Multi Scales and Multi Big Data – CM3** – Jyväskylä (Finland) – University – https://www.eccomas.org/

23-24 May – RAeS – **Future Combat Air and Space Capabilities - Conference** – London (UK) – RAeS/HQ – www.aerosociety.com

22-24 May – ESA – **Conference: New capabilities and countries in European Space** – London (UK) – RAeS/HQ – www.aerosociety.com

23-25 May – EBAA/NBAA – **EBACE 2023** – European Business Aviation Conference and Exposition – Geneva (Switzerland) – Geneva Palexpo Geneva – https://ebace.aero/2023/about/

25 May- **01** June – AIAA – **International Space Planes and Hypersonic Systems and Technologies Conference** – Bengaluru, Karnakata (India) – www.aiaa.org/events/

JUNE

05-07 June – ECCOMAS – **COUPLED PROBLEMS 2023** – X International Conference on Coupled Problems in Science and Engineering – Chania, Crete Island (Greece) – https://coupled2023.cimne.com

07-08 June – FSF/EUROCONTROL/ERA – **Safety Forum 2023 – 10th Edition** – Brussels (Belgium) – EUROCONTROL/HQ – Rue de la Fusée 96 – https://flightsafety.org/

07-09 June – SARES – **ISUDEF'23** – International Symposium on Unmanned Systems: AI, Design and Efficiency – Stockholm (Sweden) – HELD FULLY ON LINE https://2023.isudef.org/submission-and-registration/ - **SARES:** international Sustainable Aviation and Energy Research Society

07-09 June – AIAA – **RAST 2023** – 10th International Conference on Recent Advances in Air and Space Technologies – Istanbul (Turkey) – www.aiaa.org/events/

12-16 June – ESA – **GNC 2023 - 12th International ESA Conference on GNC Systems** – Sopot (Poland) – https://atpi.eventair.com/

12-16 June – AIAA – **AIAA AVIATION Forum** – San Diego, CA (USA) – www.aiaa.org/events - www.aiaa.org/aviation

13-14 June – 3AF– **ETTC2023 - European Test and Telemetry Conference** – Toulouse (France) – http://ettc2023.org/

13-15 June – 3AF – **IAMD2023 – 15th International Conference Integrated Air and Missile Defence** – Porto (Portugal) – https://www.3af-integratedairmissiledefence.com

19-21 June – ECCOMAS – **ADMOS 2023 – X International Conference on Adaptative Modelling and Simulation** – Gotheburg (Sweden) – https://admos2023.cimne.com

19-21 June – AIDAA – **SSDM 2023 – ASME Aerospace**

AMONG UPCOMING AEROSPACE EVENTS

Structures, Structural Dynamics and Materials Conference – San Diego, CA (USA) – Westin Sandiego Bayview – https://event.asme.org/SSDM

19-25 June – GIFAS/SIAE – **SIAE2023 – Paris International Air Show (54th Edition)** – Le Bourget (France) – https://www.siae.fr

20-22 June – SAE International – **International Conference on Icing of Aircraft Engines and Structures 2023** – Ensuring Aircraft, Engines, and Structures Operations Safety and Efficiency in Icing Conditions - Vienna (Austria) - https://www.sae.org/attend/icing/

21-23 June – ICEAF – **7th International Conference on Engineering Against Failures** – Spetses (Greece) – http://iceaf.eu

26-28 June – ACI EUROPE – **ACI EUROPE/World Annual Global Assembly 2023** – Hosted by Aena – Barcelona (Spain) – https://www.aci-europe.org/events.html

27-30 June – AIAA – **ICNPAA 2023** – International Conference on Mathematical Problems of Engineering, Aerospace and Sciences – Prague (Czech Republic) – Czech Technical University - www.icnpaa.com

JULY

05-07 July – SARES – **ISEAS'23** – International Symposium on Electric aircraft and Autonomous Systems – Warsaw (Poland) – Institute of Aviation – HYBRID Mode - https://2023.iseasci.org/

09-13 July – CEAS/EUCASS – **AEC2023 – Joint 10th EUCASS – 9th CEAS Conference** – Lausanne (Switzerland) https://www.eucass-ceas-2023.eu

26-28 July – SARES – **ISSA'2023** – International Symposium on Sustainable Aviation – Taiwan – Tainan City – National Cheng Kung University – HYBRID Mode – https://2023.issasci.org

AUGUST

13-17 August – AAS/AIAA – **2023 AAS/AIAA Astrodynamics Specialist Conference** –Big Sky, MT (USA) – https://space-flight.org

24-26 August – SARES – **ISATECH'23** –International Symposium on Aircraft Technology, MRO and Operations – Hanoi (Vietnam) – HYBRID Mode – https://2023.isatech.org/-symposium.isatech@gmail.com

SEPTEMBER

September-October (Date TBD) - ESA – **HAPS4ESA** – State-of-the-Art and Future Perspectives in High Altitude Pseudo Satellites (HAPS) Flights and Applications – Leiden (NL) (TBC) – https://atpi.eventsair.com

03-06 September – EUROMECH – **ETC18 2023 – 18th European Turbulence Conference** – Valencia (Italy) – https://www.euromech.org/ www.etc18.webs.es

04-06 September – EUROMECH – **Conference Data Driven Fluid Mechanics** – Italy – 629.euromech.org – https://euromech.org/

04-07 September – AIDAA – **AIDAA XXVII International Congress** – Padova (Italy) – University of Padova – https://www.aidaa.it/aidaa2023/

05-07 September – DGLR/CEAS – **ERF2023 – 49th European Rotorcraft Forum** – Bückeburg (Germany – Lower Saxory) – https://erf2023.dglr.de - https://ceas.org/european_rotorcraft_forum

05-08 September – EASN – **13th International Conference on Innovation and Space for opening New Horizons** – Salermo (Italy) – https://easnconferenec.eu

12-14 September – RAeS – **RAeS – FDM2023** – Fracture, Damage and Structural Monitoring – To promote further international co-operation among scientists and engineers from different disciplinesinvolved in FDM – London (UK) – Imperial College London – South Kensington Campus - http://fdm.engineeringconference.net.new/

12-15 September – EUROMECH – **Conference Finite Fracture Mechanics** – Lyon (France) – 635.euromech.org – https://euromech.org/

14-16 September – ESA – **41st Antenna Workshop** – Noordwijk (NL) – ESA/ESTEC – https://atpi.eventair.com/

19-21 September – DGLR – **General Aerospace Congress – DLRK 2023 - Luft und Raumfahrtkongress 2023** – Stuttgart (Germany) – https://dlrk2023.dglr.de – contact: dlrk@dglr.de

20-22 September – RAeS – **President's Conference 2023 – Future of Flight Summit** – London (UK) – RAeS/HQ – www.aerosociety.com/events

22-24 September – DGLR – **German Aerospace Congress** – https://dlrk2023.dglr.de

OCTOBER

02-06 October – IAF – **74th International Astronautical Congress** – Global challenges and Opportunities – Give Space a Chance - Baku (Azerbaijan) www.iac2023.org

02-06 October – ESA – **ESPC 2023 – European Space Power Conference - 13th Edition** – Elche (Spain) (NL) – https://atpi.eventair.com/

AMONG UPCOMING AEROSPACE EVENTS

02-06 October – ESA – **EDHPC 2023 – European Data Handling & Data Processing Conference** – Juan-les-Pins (France) – https://atpi.eventair.com/

03-05 October – RAeS – **8th Aircraft Structural Design Conference**

11-13 October – WEC - **WEC 2023 – 7th World Engineers Convention** - Prague (Czech Republic) – https://www.wec2023.com

17-19 October – MRO Europe Aviation Week – **MRO Europe Conference** - RAI Amsterdam (NL) – https://mroeurope.aviationweek.com/en/home/html

17-22 October – SEOUL – Seoul ADEX 2023 – **Seoul International Aerospace & Defense Exhibition 2023** - Seoul (South Korea) – Seoul Airport – Seongnam Air Base – www.seouladex.com/intro/intro.php

23-25 October – AIAA – **2023 ASCEND – Accelerating Space Commerce Exploration and New Discoveries** – Las Vegas, Nevada (USA) – Las Vegas and ONLINE – https://aiaa.org/events

23-26 October – ASCEND/AIAA – **ASCEND Conference** – Las Vegas, NV (USA) – www.aiaa.org/events

23-27 October – ESA – **ISSO – International School on Space Optics** – Noordwijk (NL) – ESA/ESTEC – https://atpi.eventair.com/

NOVEMBER

12-16 November – UAE– **Dubai Airshow 2023 – The Center of Aerospace Strategy and Inspiration** – Dubai (UAE) – Dubai World Central Al Maktoum Jebel Ali – https://www.dubaiairshow.aero

14-15 November – 3AF – **CAT 2035 – Combat Aéroterrestre 2035 - 2nd Edition** – Versailles (France) – https://www.3af-cat2035.com

16-18 November – The Scientist – **GSEAMAE 2023 – 3rd Global Summit and Exposition on Aerospace and Mechanical Engineering** – Rome (Italy) – https://www.thescientist.com/2023/aerospace-mechanical-engineering - contact: gseame2023@thescientist.com